**行业标准《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》**

**编制说明**

**(送审稿)**

行业标准《掺锡氧化铟粉化学分析方法》起草小组

　 2019.4

1. **任务来源**

根据工信厅科[2017]40号《工业和信息化部办公厅关于印发2017年第一批行业标准制修订计划的通知》，全国有色金属标准化技术委员会文件“有色标委【2017】31号”《关于转发2017年有色金属国家、行业、协会标准制（修）订项目计划的通知》”，以及全国有色金属标准化技术委员会文件“有色标委【2017】95号”，“关于印发《掺锡氧化铟粉化学分析方法》等18项标准任务落实会会议纪要的通知”，《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》行业标准由广西壮族自治区冶金产品质量检验站负责起草，标准起草单位为广西壮族自治区分析测试研究中心，第一验证单位为广西晶联光电材料有限责任公司、北矿检测技术有限公司、广西壮族自治区地质矿产测试研究中心，第二验证单位为广东先导稀材股份有限公司、南宁奥博斯检测科技有限责任公司、国标（北京）检验认证有限公司、洛阳晶联光电材料有限责任公司、昆明冶金研究院。

项目计划号：2017-0135T-YS，完成时间2019年。

**二、编制过程（包括编制原则、工作分工、征求意见单位、各阶段工作过程等）** **1. 标准制订主要遵循的原则**

**1)** 符合性：本标准格式严格按照国家标准《标准化工作导则》GB/T 1.1-2009、标准编写规则 第4部分：试验方法标准GB/T 20001.4-2014的要求编写，并符合有色行业标准编制要求。

**2)** 合理性：本标准反映了国内生产、贸易、检验等企事业的技术水平，便于生产，利于应用，经济上合理，兼顾现有资源的合理配置，同时也可以起到规范和引导生产及消费市场的作用。

**3)** 创新性：本标准填补了国内掺锡氧化铟粉检测标准的空白，满足掺锡氧化铟粉生产行业的检测要求，适应高技术新材料产业的高质量发展。

**2. 工作过程**

**2.1** 立项批准

2017年4月12日，国家工业和信息化部下发《工业和信息化部办公厅关于印发2017年第一批行业标准制修订计划的通知》（工信厅科[2017]40号），2017年9月11日，全国有色金属标准化技术委员会下发“关于转发2017年有色金属国家、行业、协会标准制（修）订项目计划的通知”（有色标委【2017】31号），《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》行业标准获准立项，项目计划号：2017-0135T-YS，完成时间2019年。

批准立项后，由广西壮族自治区冶金产品质量检验站为牵头，成立了行业标准《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》起草小组，负责该标准起草前期工作。

**2.2** 任务落实

根据国家标准化管理委员会及工业和信息化部标准计划项目的安排要求，全国有色金属标准化技术委员会于2017年8月22日～8月24日在山东省泰安市召开有色标准工作会议，会议代表就行业标准《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》（项目计划号：2017-0135T-YS）起草有关问题进行讨论，全国有色金属标准化技术委员会进一步明确各责任单位（人）的具体工作安排，并形成了会议纪要：“有色标委【2017】95号”，“关于印发《掺锡氧化铟粉化学分析方法》等18项标准任务落实会会议纪要的通知”。

本标准起草小组经与各个起草单位协商一致，并经全国有色金属标准化技术委员会同意，行业标准起草分工如下：

广西壮族自治区冶金产品质量检验站为牵头、负责起草单位，统筹协调标准起草各项工作；

广西壮族自治区分析测试研究中心负责起草的试验研究工作、起草标准文本；

广西壮族自治区冶金产品质量检验站、广西壮族自治区分析测试研究中心、广东先导稀材股份有限公司负责制备试验所用的比对样品。由广西壮族自治区冶金产品质量检验站分发给试验单位。

第一验证单位：广西晶联光电材料有限责任公司、北矿检测技术有限公司、广西壮族自治区地质矿产测试研究中心、广西壮族自治区冶金产品质量检验站；

第二验证单位：广东先导稀材股份有限公司、南宁奥博斯检测科技有限责任公司、国标（北京）检验认证有限公司、洛阳晶联光电材料有限责任公司、昆明冶金研究院。

**2.3** **各阶段工作过程**

**1）**2017年10月24日至10月26日，标准起草小组人员参加了全国有色金属标准工作会议，对起草《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》行业标准进行了研讨。会后，充实了标准起草小组人员，确定了建标的工作计划和进度安排，建标工作任务落实到位。

**2）**2017年11月～2018年3月，标准起草小组收集、整理有关《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》资料。标准起草小组在广西壮族自治区冶金产品质量检验站进行初步探索性试验研究。

**3）**2018年4月，标准起草小组在广西壮族自治区冶金产品质量检验站，召开了第一次标准起草工作会议。会议参加单位为标准起草的主要单位，有广西壮族自治区冶金产品质量检验站、广西壮族自治区分析测试研究中心、广西晶联光电材料有限责任公司、南宁奥博斯检测科技有限责任公司、桂林理工大学南宁分校、广西壮族自治区地质矿产测试研究中心等。会议讨论了分析方法的试验情况和比对样品研制等内容，并形成了标准讨论稿初稿。

**4）**2018年5月～6月，标准讨论稿初稿征求各起草单位意见，并做初步修改。标准起草小组人员到广东清远广东先导稀材股份有限公司、广西晶联光电材料有限责任公司进行调研。

**5）**2018年6月，广西壮族自治区冶金产品质量检验站和广西壮族自治区分析测试中心、广东先导稀材股份有限公司的标准制定小组人员通力合作，完成了比对样品的设计，并由广东先导稀材股份有限公司完成了比对样品的研制。

**6）**2018年3月～10月分析方法试验研究、验证单位试验验证。标准讨论稿进一步修改完善，并向全国有色金属标准化技术委员会重金属分标委汇报标准起草情况。

**7）**2018年10月，标准讨论稿修改完善，形成标准预审稿，并在[www.cnsmq.com](http://www.cnsmq.com)挂网，征求意见。

**8）**2018年10月24日至26日，标准起草小组人员参加了在安徽省合肥市召开的全国有色金属标准工作会议。全国有色金属标准化技术委员会组织业内专家对《掺锡氧化铟粉化学分析方法 第1部分： 铁、铝、铅、镍、铜、镉、铬、铊含量的测定 电感耦合等离子体原子发射光谱法》行业标准进行了预审。会上，标准起草单位向与会专家汇报了标准的起草过程、回答专家的质询，听取了专家的修改意见和建议。

**9）**2018年11月14日，全国有色金属标准化技术委员会下文“有色标秘[2018]63号”：“关于印发《掺锡氧化铟粉》等5项标准预审会会议纪要的通知”。

**10）**2018年11月15日，标准起草小组主要成员在广西壮族自治区冶金产品质量检验站召开了工作会议，就落实会议纪要“有色标秘[2018]63号”文精神做了安排。会后，标准起草小组成员分头开展相关工作。

**11）**2018年12月12日，全国有色金属标准化技术委员会下文“有色标秘[2018]71号”：“关于开展锡领域企业现场调研的函”。2018年12月16日至20日，全国有色金属标准化技术委员会对广西华锡集团股份有限公司、柳州百韧特先进材料有限公司、广西晶联光电材料有限责任公司、广西壮族自治区冶金产品质量检验站等单位进行了现场调研，标准起草小组主要成员参与了调研活动。

**12）**2019年1-2月，标准预审稿进一步修改完善。

**13）**2019年3月29日，标准起草小组主要成员单位广西晶联光电材料有限责任公司、广西壮族自治区分析测试研究中心、广西壮族自治区地质矿产测试研究中心在广西壮族自治区冶金产品质量检验站召开了工作会议，对标准终审稿初稿进行集中讨论修改，形成标准终审稿。

**14）**2019年4月，标准终审稿在[www.cnsmq.com](http://www.cnsmq.com)挂网，征求意见。

**三、主要试验（或验证）的分析、综述报告**

**1、标准提出背景**

我国是铟资源大国，也是铟产品生产的主要国家，占据了世界铟年产量50%以上。金属铟具有延展性好，可塑性强，熔点低，沸点高，低电阻，抗腐蚀等优良特性，且具有较好的光渗透性和导电性，被广泛应用于宇航、无线电和电子工业、医疗、国防、高新技术、能源等领域。生产ITO靶材是金属铟的主要消费领域，占全球铟消费量的70%，ITO靶材通过磁控溅射获得的ITO导电膜作为透明电极广泛应用于笔记本电脑、电脑显示器、智能手机、液晶电视等。掺锡氧化铟粉是生产ITO靶材的主要原料，使用量日益增多，已成为当今信息产业极为重要的基础电子功能材料。掺锡氧化铟粉产品及其检测方法的规范化和标准化，对“中国制造2025”有着积极的促进作用。

目前，掺锡氧化铟粉分析检测鲜有报道，国内外尚未见关于掺锡氧化铟粉中杂质成分测定的分析方法标准，也没有直接可以引用的化学分析方法标准。为了更好推广掺锡氧化铟粉的应用，规范掺锡氧化铟粉交易双方的贸易行为，促进国内生产商的良性竞争，向国内外用户提供优质的产品，制定掺锡氧化铟粉产品检验标准势在必行。

掺锡氧化铟粉属于高纯材料，一般以高纯金属铟、锡为原料，经共沉淀法或混合法工艺制得。杂质元素一般有铁、铝、铅、镍、铜、镉、铬、铊、硅等，杂质元素含量都控制在0.010%以下。

电感耦合等离子体原子发射光谱仪 （ICP-AES）是目前国内外比较先进的现代分析仪器之一，该仪器具有如下优点：1.检出限很低，达到10-12级；2.谱线简单，谱线干扰少；3.能同时测定多元素；4.动态范围宽。ICP- AES自从20世纪60年代开始发展以来，已在地质，环境，医学，材料，石油化工等诸多领域得到了广泛应用，作为快速，简便，有力的分析工具，ICP-AES正逐渐应用到生产的例行分析中。

经调研发现，目前国内外掺锡氧化铟粉的生产企业和用户，对掺锡氧化铟粉中铁、铝、铅、镍、铜、镉、铬、铊元素的测定，大多采用电感耦合等离子体发射光谱法。

**2、分析方法标准研究情况**

**1）**方法提要

试料经氢氧化钠熔融，热水浸出盐酸酸化后，用电感耦合等离子体原子发射光谱仪测定试料溶液中待测元素特征谱线的强度，通过标准曲线法计算出试料中铁、铝、铅、镍、铜、镉、铬、铊含量。

铁、铝、铅、镍、铜、镉、铬、铊各元素检出限在0.0023～0.0085 μg/mL，6个掺锡氧化铟粉样品的精密度(RSD值)在1.92%～14.44%，3#、6#掺锡氧化铟粉的加标回收率在95.0%～112.1%，测定范围为： 0.0005%～0.010%，满足掺锡氧化铟粉中杂质元素分析要求。

**2）**试料分解

对掺锡氧化铟粉样品进行了微波消解、碱熔溶解试验。结果是将0.50 g试样（精确至0.000 1g），置于银坩埚中，加入2.0 g氢氧化钠放入500 ℃马弗炉保温5 min，再升温至700 ℃保温15 min，能完全将样品分解。

**3）**基体干扰情况

掺锡氧化铟粉的原料均为高纯物质，杂质元素含量都较低，基体干扰也主要考虑铟、锡。试验结果表明按本方法测定，铟、锡基体对铁、铝、铅、镍、铜、镉、铬、铊的测定不干扰。

**4）**试验验证

起草单位、一验证单位、部分二验证单位比对样品分析结果吻合。

1. 起草单位广西壮族自治区分析测试研究中心比对样品分析结果：

1#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00071 | 0.00061 | 0.00071 | 0.00065 | 0.00051 | 0.00056 | 0.00057 | 14.44 |
| 0.00046 | 0.00056 | 0.00052 | 0.00048 | 0.00053 |  |
| Al | 0.00058 | 0.00062 | 0.00060 | 0.00074 | 0.00066 | 0.00060 | 0.00066 | 9.89 |
| 0.00072 | 0.00071 | 0.00079 | 0.00065 | 0.00061 |  |
| Pb | 0.00038 | 0.00057 | 0.00040 | 0.00046 | 0.00055 | 0.00053 | 0.00047 | 12.65 |
| 0.00046 | 0.00042 | 0.00042 | 0.00048 | 0.00046 |  |
| Ni | 0.00034 | 0.00042 | 0.00040 | 0.00039 | 0.00043 | 0.00042 | 0.00039 | 9.54 |
| 0.00039 | 0.00045 | 0.00036 | 0.00032 | 0.00039 |  |
| Cu | 0.00063 | 0.00063 | 0.00060 | 0.00060 | 0.00061 | 0.00062 | 0.00061 | 4.67 |
| 0.00056 | 0.00064 | 0.00058 | 0.00060 | 0.00067 |  |
| Cd | 0.00046 | 0.00050 | 0.00044 | 0.00045 | 0.00046 | 0.00039 | 0.00048 | 9.69 |
| 0.00048 | 0.00054 | 0.00057 | 0.00048 | 0.00047 |  |
| Cr | 0.00073 | 0.00062 | 0.00076 | 0.00074 | 0.00066 | 0.00061 | 0.00068 | 7.65 |
| 0.00072 | 0.00071 | 0.00070 | 0.00065 | 0.00061 |  |
| Tl | 0.00039 | 0.00051 | 0.00050 | 0.00054 | 0.00052 | 0.00048 | 0.00049 | 9.11 |
| 0.00050 | 0.00044 | 0.00049 | 0.00045 | 0.00055 |  |

2#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00091 | 0.00091 | 0.00101 | 0.00095 | 0.00107 | 0.00119 | 0.00096 | 9.90 |
| 0.00098 | 0.00092 | 0.00088 | 0.00083 | 0.00092 |  |
| Al | 0.00110 | 0.00099 | 0.00102 | 0.00128 | 0.00131 | 0.00126 | 0.00119 | 8.82 |
| 0.00122 | 0.00116 | 0.00119 | 0.00126 | 0.00129 |  |
| Pb | 0.00111 | 0.00102 | 0.00119 | 0.00120 | 0.00096 | 0.00094 | 0.00103 | 9.86 |
| 0.00086 | 0.00093 | 0.00105 | 0.00104 | 0.00106 |  |
| Ni | 0.00077 | 0.00089 | 0.00095 | 0.00095 | 0.00087 | 0.00084 | 0.00084 | 7.58 |
| 0.00076 | 0.00079 | 0.00078 | 0.00083 | 0.00085 |  |
| Cu | 0.00102 | 0.00110 | 0.00103 | 0.00106 | 0.00086 | 0.00105 | 0.00104 | 8.08 |
| 0.00101 | 0.00106 | 0.00118 | 0.00114 | 0.00094 |  |
| Cd | 0.00085 | 0.00088 | 0.00100 | 0.00086 | 0.00099 | 0.00101 | 0.00089 | 7.86 |
| 0.00085 | 0.00088 | 0.00079 | 0.00089 | 0.00083 |  |
| Cr | 0.00110 | 0.00109 | 0.00108 | 0.00128 | 0.00121 | 0.00110 | 0.00119 | 5.74 |
| 0.00122 | 0.00116 | 0.00119 | 0.00126 | 0.00122 |  |
| Tl | 0.00085 | 0.00090 | 0.00095 | 0.00077 | 0.00094 | 0.00101 | 0.00090 | 8.38 |
| 0.00100 | 0.00086 | 0.00078 | 0.00091 | 0.00093 |  |

3#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值5 | RSD % |
| Fe | 0.00242 | 0.00253 | 0.00229 | 0.00238 | 0.00302 | 0.00286 | 0.00268 | 9.57 |
| 0.00249 | 0.00303 | 0.00272 | 0.00296 | 0.00273 |  |
| Al | 0.00238 | 0.00238 | 0.00244 | 0.00278 | 0.00241 | 0.00226 | 0.00244 | 6.37 |
| 0.00234 | 0.00225 | 0.00246 | 0.00269 | 0.00248 |  |
| Pb | 0.00242 | 0.00267 | 0.00279 | 0.00237 | 0.00201 | 0.00204 | 0.00240 | 9.20 |
| 0.00240 | 0.00232 | 0.00241 | 0.00245 | 0.00254 |  |
| Ni | 0.00225 | 0.00236 | 0.00223 | 0.00231 | 0.00211 | 0.00203 | 0.00214 | 6.24 |
| 0.00198 | 0.00199 | 0.00195 | 0.00217 | 0.00213 |  |
| Cu | 0.00277 | 0.00273 | 0.00249 | 0.00263 | 0.00256 | 0.00267 | 0.00256 | 5.60 |
| 0.00229 | 0.00263 | 0.00253 | 0.00245 | 0.00236 |  |
| Cd | 0.00216 | 0.00221 | 0.00210 | 0.00214 | 0.00203 | 0.00199 | 0.00202 | 5.69 |
| 0.00188 | 0.00200 | 0.00191 | 0.00186 | 0.00192 |  |
| Cr | 0.00252 | 0.00253 | 0.00269 | 0.00268 | 0.00262 | 0.00286 | 0.00266 | 4.05 |
| 0.00249 | 0.00263 | 0.00272 | 0.00276 | 0.00273 |  |
| Tl | 0.00219 | 0.00225 | 0.00252 | 0.00264 | 0.00233 | 0.00228 | 0.00237 | 5.29 |
| 0.00233 | 0.00244 | 0.00236 | 0.00246 | 0.00229 |  |

4#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00544 | 0.00533 | 0.00546 | 0.00561 | 0.00603 | 0.00608 | 0.00550 | 5.29 |
| 0.00521 | 0.00557 | 0.00519 | 0.00537 | 0.00524 |  |
| Al | 0.00507 | 0.00573 | 0.00569 | 0.00502 | 0.00502 | 0.00545 | 0.00538 | 5.01 |
| 0.00543 | 0.00513 | 0.00573 | 0.00539 | 0.00556 |  |
| Pb | 0.00522 | 0.00493 | 0.00533 | 0.00495 | 0.00493 | 0.00513 | 0.00492 | 3.43 |
| 0.00469 | 0.00501 | 0.00478 | 0.00463 | 0.00487 |  |
| Ni | 0.00467 | 0.00456 | 0.00462 | 0.00471 | 0.00418 | 0.00472 | 0.00465 | 4.78 |
| 0.00462 | 0.00461 | 0.00476 | 0.00518 | 0.00455 |  |
| Cu | 0.00536 | 0.00486 | 0.00503 | 0.00520 | 0.00503 | 0.00502 | 0.00502 | 4.24 |
| 0.00481 | 0.00470 | 0.00526 | 0.00519 | 0.00472 |  |
| Cd | 0.00459 | 0.00441 | 0.00432 | 0.00436 | 0.00442 | 0.00426 | 0.00442 | 2.81 |
| 0.00462 | 0.00461 | 0.00428 | 0.00443 | 0.00434 |  |
| Cr | 0.00584 | 0.00603 | 0.00556 | 0.00561 | 0.00603 | 0.00608 | 0.00589 | 3.86 |
| 0.00561 | 0.00577 | 0.00619 | 0.00587 | 0.00624 |  |
| Tl | 0.00515 | 0.00470 | 0.00471 | 0.00529 | 0.00514 | 0.00511 | 0.00489 | 4.61 |
| 0.00461 | 0.00482 | 0.00469 | 0.00473 | 0.00483 |  |

5#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00831 | 0.00846 | 0.00775 | 0.00837 | 0.00860 | 0.00842 | 0.00815 | 4.48 |
| 0.00788 | 0.00754 | 0.00812 | 0.00853 | 0.00763 |  |
| Al | 0.00741 | 0.00746 | 0.00771 | 0.00820 | 0.00722 | 0.00712 | 0.00748 | 3.84 |
| 0.00767 | 0.00732 | 0.00742 | 0.00756 | 0.00723 |  |
| Pb | 0.00677 | 0.00715 | 0.00814 | 0.00686 | 0.00721 | 0.00716 | 0.00732 | 4.85 |
| 0.00752 | 0.00760 | 0.00733 | 0.00742 | 0.00738 |  |
| Ni | 0.00723 | 0.00806 | 0.00752 | 0.00692 | 0.00752 | 0.00771 | 0.00749 | 3.93 |
| 0.00783 | 0.00724 | 0.00746 | 0.00741 | 0.00745 |  |
| Cu | 0.00801 | 0.00766 | 0.00838 | 0.00736 | 0.00733 | 0.00780 | 0.00758 | 4.63 |
| 0.00734 | 0.00762 | 0.00710 | 0.00743 | 0.00735 |  |
| Cd | 0.00674 | 0.00711 | 0.00667 | 0.00721 | 0.00723 | 0.00726 | 0.00713 | 3.21 |
| 0.00741 | 0.00722 | 0.00706 | 0.00711 | 0.00742 |  |
| Cr | 0.00831 | 0.00846 | 0.00875 | 0.00837 | 0.00860 | 0.00842 | 0.00857 | 2.45 |
| 0.00858 | 0.00854 | 0.00912 | 0.00853 | 0.00863 |  |
| Tl | 0.00815 | 0.00770 | 0.00781 | 0.00789 | 0.00801 | 0.00813 | 0.00794 | 1.92 |
| 0.00782 | 0.00819 | 0.00784 | 0.00786 | 0.00792 |  |

6#试样的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.0107 | 0.0103 | 0.0109 | 0.0110 | 0.0105 | 0.0114 | 0.0108 | 3.68 |
| 0.00998 | 0.0112 | 0.0107 | 0.0110 | 0.0111 |  |
| Al | 0.00992 | 0.0103 | 0.0105 | 0.00990 | 0.0102 | 0.00964 | 0.0101 | 3.61 |
| 0.0104 | 0.0108 | 0.00973 | 0.00966 | 0.00987 |  |
| Pb | 0.00885 | 0.00914 | 0.00891 | 0.00959 | 0.00865 | 0.00914 | 0.00909 | 4.76 |
| 0.00861 | 0.00977 | 0.00923 | 0.00950 | 0.00903 |  |
| Ni | 0.00936 | 0.0101 | 0.00960 | 0.00921 | 0.0102 | 0.00965 | 0.00951 | 3.50 |
| 0.00943 | 0.00922 | 0.00934 | 0.00946 | 0.00915 |  |
| Cu | 0.00995 | 0.0105 | 0.0105 | 0.0103 | 0.00980 | 0.00946 | 0.00984 | 4.02 |
| 0.00966 | 0.00964 | 0.00941 | 0.00954 | 0.00948 |  |
| Cd | 0.00928 | 0.00921 | 0.00940 | 0.00967 | 0.00910 | 0.00962 | 0.00943 | 2.68 |
| 0.0100 | 0.00952 | 0.00943 | 0.00929 | 0.00916 |  |
| Cr | 0.0107 | 0.0112 | 0.0109 | 0.0110 | 0.0105 | 0.0104 | 0.0109 | 2.38 |
| 0.0110 | 0.0112 | 0.0107 | 0.0110 | 0.0111 |  |
| Tl | 0.00924 | 0.0102 | 0.00981 | 0.00989 | 0.00926 | 0.00936 | 0.00972 | 3.70 |
| 0.0101 | 0.00983 | 0.00991 | 0.0101 | 0.00922 |  |

（2）一验单位广西壮族自治区冶金产品质量检验站比对样品分析结果：

试料1#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.00068 0.00058 0.00066 0.00072 0.00055 0.00064 0.00054 0.00059 0.00051 0.00047 0.00059 | 0.00059 | 12.75 |
| Al | 0.00062 0.00075 0.00068 0.00072 0.00069 0.00056 0.00066 0.00077 0.00076 0.00060 0.00064 | 0.00068 | 10.17 |
| Pb | 0.00042 0.00049 0.00044 0.00045 0.00039 0.00036 0.00052 0.00050 0.00052 0.00041 0.00059 | 0.00046 | 14.66 |
| Ni | 0.00040 0.00044 0.00037 0.00034 0.00047 0.00034 0.00037 0.00042 0.00035 0.00030 0.00039 | 0.00038 | 12.99 |
| Cu | 0.00067 0.00055 0.00058 0.00053 0.00070 0.00060 0.00062 0.00066 0.00055 0.00055 0.00073 | 0.00061 | 11.17 |
| Cd | 0.00044 0.00056 0.00046 0.00042 0.00041 0.00043 0.00040 0.00052 0.00057 0.00047 0.00049 | 0.00047 | 12.52 |
| Cr | 0.00065 0.00060 0.00073 0.00073 0.00064 0.00061 0.00075 0.00073 0.00067 0.00060 0.00065 | 0.00067 | 8.49 |
| Tl | 0.00041 0.00055 0.00042 0.00048 0.00054 0.00051 0.00050 0.00048 0.00050 0.00051 0.00042 | 0.00048 | 9.93 |

试料2#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.00096 0.00088 0.00098 0.00112 0.00105 0.00111 0.00096 0.00105 0.00087 0.00089 0.00098 | 0.00099 | 8.89 |
| Al | 0.00114 0.00112 0.00095 0.00114 0.00123 0.00124 0.00109 0.00110 0.00116 0.00121 0.00132 | 0.00115 | 8.40 |
| Pb | 0.00098 0.00095 0.00105 0.00112 0.00095 0.00088 0.00089 0.00088 0.00102 0.00099 0.00112 | 0.00098 | 8.82 |
| Ni | 0.00083 0.00091 0.00092 0.00090 0.00091 0.00076 0.00074 0.00076 0.00077 0.00081 0.00085 | 0.00083 | 8.32 |
| Cu | 0.00097 0.00109 0.00097 0.00102 0.00091 0.00102 0.00096 0.00112 0.00105 0.00097 0.00108 | 0.00101 | 6.41 |
| Cd | 0.00083 0.00094 0.00102 0.00085 0.00094 0.00105 0.00093 0.00086 0.00079 0.00088 0.00085 | 0.00090 | 8.91 |
| Cr | 0.00107 0.00102 0.00104 0.00120 0.00120 0.00104 0.00125 0.00111 0.00116 0.00121 0.00128 | 0.00114 | 8.03 |
| Tl | 0.00089 0.00098 0.00093 0.00087 0.00093 0.00103 0.00102 0.00084 0.00084 0.00093 0.00090 | 0.00092 | 7.05 |

试料3#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.00250 0.00279 0.00243 0.00258 0.00286 0.00282 0.00223 0.00291 0.00266 0.00286 0.00279 | 0.00268 | 8.10 |
| Al | 0.00254 0.00234 0.00270 0.00266 0.00235 0.00236 0.00240 0.00243 0.00272 0.00255 0.00268 | 0.00252 | 5.99 |
| Pb | 0.00236 0.00257 0.00273 0.00255 0.00227 0.00228 0.00260 0.00248 0.00237 0.00251 0.00242 | 0.00247 | 5.78 |
| Ni | 0.00219 0.00218 0.00229 0.00207 0.00213 0.00209 0.00204 0.00189 0.00199 0.00223 0.00201 | 0.00210 | 5.58 |
| Cu | 0.00239 0.00279 0.00225 0.00265 0.00272 0.00253 0.00239 0.00267 0.00259 0.00233 0.00242 | 0.00252 | 6.99 |
| Cd | 0.00210 0.00203 0.00216 0.00190 0.00205 0.00215 0.00194 0.00190 0.00195 0.00192 0.00180 | 0.00199 | 5.79 |
| Cr | 0.00270 0.00279 0.00273 0.00288 0.00278 0.00282 0.00255 0.00251 0.00266 0.00266 0.00267 | 0.00270 | 4.13 |
| Tl | 0.00221 0.00241 0.00258 0.00254 0.00237 0.00234 0.00221 0.00238 0.00228 0.00252 0.00253 | 0.00240 | 5.52 |

试料4#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.00560 0.00555 0.00574 0.00601 0.00581 0.00600 0.00509 0.00533 0.00507 0.00517 0.00536 | 0.00552 | 6.23 |
| Al | 0.00559 0.00545 0.00529 0.00534 0.00510 0.00523 0.00519 0.00501 0.00523 0.00551 0.00562 | 0.00532 | 3.73 |
| Pb | 0.00526 0.00501 0.00521 0.00491 0.00481 0.00523 0.00481 0.00517 0.00486 0.00449 0.00479 | 0.00496 | 4.85 |
| Ni | 0.00435 0.00436 0.00474 0.00487 0.00476 0.00458 0.00494 0.00469 0.00444 0.00436 0.00463 | 0.00461 | 4.58 |
| Cu | 0.00516 0.00498 0.00529 0.00548 0.00489 0.00534 0.00485 0.00478 0.00514 0.00495 0.00492 | 0.00507 | 4.46 |
| Cd | 0.00471 0.00457 0.00460 0.00432 0.00430 0.00442 0.00454 0.00447 0.00460 0.00451 0.00422 | 0.00448 | 3.34 |
| Cr | 0.00600 0.00551 0.00584 0.00601 0.00571 0.00600 0.00549 0.00553 0.00607 0.00567 0.00636 | 0.00584 | 4.78 |
| Tl | 0.00499 0.00462 0.00457 0.00497 0.00522 0.00499 0.00473 0.00466 0.00497 0.00487 0.00471 | 0.00485 | 4.16 |

试料5#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.00815 0.00822 0.00727 0.00813 0.00820 0.00866 0.00764 0.00706 0.00788 0.00813 0.00787 | 0.00793 | 5.78 |
| Al | 0.00789 0.00722 0.00731 0.00796 0.00706 0.00736 0.00743 0.00780 0.00718 0.00810 0.00747 | 0.00753 | 4.68 |
| Pb | 0.00739 0.00677 0.00754 0.00718 0.00729 0.00704 0.00728 0.00748 0.00713 0.00724 0.00754 | 0.00726 | 3.19 |
| Ni | 0.00731 0.00794 0.00728 0.00714 0.00732 0.00783 0.00789 0.00776 0.00774 0.00701 0.00777 | 0.00754 | 4.43 |
| Cu | 0.00789 0.00772 0.00770 0.00764 0.00778 0.00812 0.00742 0.00750 0.00750 0.00765 0.00715 | 0.00764 | 3.34 |
| Cd | 0.00690 0.00723 0.00695 0.00707 0.00691 0.00718 0.00729 0.00698 0.00694 0.00691 0.00744 | 0.00707 | 2.62 |
| Cr | 0.00859 0.00891 0.00907 0.00813 0.00820 0.00866 0.00834 0.00806 0.00888 0.00813 0.00887 | 0.00853 | 4.36 |
| Tl | 0.00787 0.00778 0.00808 0.00753 0.00773 0.00773 0.00803 0.00787 0.00822 0.00772 0.00824 | 0.00789 | 2.73 |

试料6#

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值 % | 平均值% | RSD % |
| Fe | 0.01038 0.01078 0.01064 0.01052 0.01058 0.01122 0.01046 0.01024 0.01022 0.0102 0.01062 | 0.0105 | 2.81 |
| Al | 0.01010 0.00982 0.01056 0.01038 0.01048 0.01012 0.01072 0.01032 0.00999 0.01014 0.00979 | 0.0102 | 2.93 |
| Pb | 0.00871 0.00938 0.00909 0.00963 0.00905 0.00890 0.00877 0.01001 0.00941 0.00926 0.00943 | 0.00924 | 4.20 |
| Ni | 0.00944 0.00992 0.01008 0.00937 0.00972 0.00885 0.00895 0.00890 0.00982 0.0092 0.00963 | 0.00944 | 4.54 |
| Cu | 0.01013 0.01034 0.01032 0.01022 0.01028 0.00978 0.00918 0.00990 0.00893 0.00972 0.00952 | 0.00985 | 4.86 |
| Cd | 0.00944 0.00945 0.00958 0.00943 0.00950 0.00948 0.00976 0.00970 0.00947 0.00969 0.00892 | 0.00949 | 2.35 |
| Cr | 0.01088 0.01096 0.01118 0.01052 0.01082 0.00992 0.01126 0.01168 0.01062 0.01118 0.01114 | 0.0109 | 4.23 |
| Tl | 0.00942 0.00936 0.00941 0.00975 0.00902 0.00954 0.00938 0.00959 0.00949 0.00954 0.00950 | 0.00945 | 1.92 |

（3）一验单位广西晶联光电材料有限责任公司比对样品分析结果：

试料1#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00051 | 0.00042 | 0.00051 | 0.00055 | 0.00051 | 0.00056 | 0.00052 | 9.01 |
| 0.00046 | 0.00056 | 0.00052 | 0.00048 | 0.00058 |  |
| Al | 0.00057 | 0.00062 | 0.00060 | 0.00064 | 0.00066 | 0.00060 | 0.00064 | 7.79 |
| 0.00062 | 0.00071 | 0.00075 | 0.00065 | 0.00061 |  |
| Pb | 0.00042 | 0.00042 | 0.00048 | 0.00046 | 0.00045 | 0.00053 | 0.00046 | 7.39 |
| 0.00046 | 0.00042 | 0.00046 | 0.00049 | 0.00042 |  |
| Ni | 0.00043 | 0.00042 | 0.00045 | 0.00039 | 0.00036 | 0.00035 | 0.00040 | 7.41 |
| 0.00039 | 0.00037 | 0.00042 | 0.00041 | 0.00039 |  |
| Cu | 0.00061 | 0.00063 | 0.00060 | 0.00050 | 0.00051 | 0.00062 | 0.00058 | 7.50 |
| 0.00056 | 0.00064 | 0.00058 | 0.00060 | 0.00057 |  |
| Cd | 0.00046 | 0.00050 | 0.00044 | 0.00045 | 0.00046 | 0.00049 | 0.00048 | 6.90 |
| 0.00048 | 0.00054 | 0.00047 | 0.00048 | 0.00055 |  |
| Cr | 0.00063 | 0.00062 | 0.00066 | 0.00074 | 0.00066 | 0.00061 | 0.00066 | 6.65 |
| 0.00072 | 0.00071 | 0.00070 | 0.00065 | 0.00061 |  |
| Tl | 0.00049 | 0.00051 | 0.00050 | 0.00044 | 0.00052 | 0.00048 | 0.00049 | 7.05 |
| 0.00050 | 0.00044 | 0.00049 | 0.00045 | 0.00056 |  |

试料2#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00092 | 0.00090 | 0.00101 | 0.00095 | 0.00105 | 0.00109 | 0.00095 | 7.43 |
| 0.00098 | 0.00092 | 0.00089 | 0.00084 | 0.00092 |  |
| Al | 0.00113 | 0.00099 | 0.00102 | 0.00118 | 0.00111 | 0.00106 | 0.00114 | 7.11 |
| 0.00122 | 0.00116 | 0.00119 | 0.00126 | 0.00119 |  |
| Pb | 0.00101 | 0.00102 | 0.00116 | 0.00100 | 0.00096 | 0.00094 | 0.00100 | 7.09 |
| 0.00088 | 0.00093 | 0.00105 | 0.00104 | 0.00103 |  |
| Ni | 0.00079 | 0.00089 | 0.00095 | 0.00094 | 0.00087 | 0.00084 | 0.00085 | 6.94 |
| 0.00078 | 0.00079 | 0.00078 | 0.00082 | 0.00085 |  |
| Cu | 0.00102 | 0.00111 | 0.00103 | 0.00106 | 0.00099 | 0.00105 | 0.00104 | 5.07 |
| 0.00101 | 0.00106 | 0.00112 | 0.00104 | 0.00092 |  |
| Cd | 0.00085 | 0.00088 | 0.00098 | 0.00086 | 0.00099 | 0.00098 | 0.00090 | 6.13 |
| 0.00085 | 0.00088 | 0.00089 | 0.00089 | 0.00083 |  |
| Cr | 0.00103 | 0.00119 | 0.00108 | 0.00118 | 0.00121 | 0.00110 | 0.00118 | 5.70 |
| 0.00122 | 0.00116 | 0.00119 | 0.00126 | 0.00122 |  |
| Tl | 0.00085 | 0.00092 | 0.00090 | 0.00079 | 0.00094 | 0.00091 | 0.00089 | 6.81 |
| 0.00100 | 0.00086 | 0.00079 | 0.00091 | 0.00093 |  |

试料3#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00256 | 0.00253 | 0.00239 | 0.00248 | 0.00295 | 0.00286 | 0.00267 | 7.07 |
| 0.00247 | 0.00273 | 0.00270 | 0.00296 | 0.00270 |  |
| Al | 0.00238 | 0.00258 | 0.00244 | 0.00278 | 0.00251 | 0.00226 | 0.00247 | 6.22 |
| 0.00234 | 0.00229 | 0.00246 | 0.00269 | 0.00248 |  |
| Pb | 0.00242 | 0.00267 | 0.00269 | 0.00237 | 0.00221 | 0.00219 | 0.00244 | 6.20 |
| 0.00240 | 0.00242 | 0.00241 | 0.00249 | 0.00254 |  |
| Ni | 0.00225 | 0.00229 | 0.00223 | 0.00231 | 0.00201 | 0.00203 | 0.00212 | 6.06 |
| 0.00199 | 0.00199 | 0.00194 | 0.00215 | 0.00213 |  |
| Cu | 0.00269 | 0.00273 | 0.00258 | 0.00263 | 0.00257 | 0.00267 | 0.00256 | 4.83 |
| 0.00234 | 0.00263 | 0.00250 | 0.00245 | 0.00237 |  |
| Cd | 0.00201 | 0.00216 | 0.00203 | 0.00214 | 0.00210 | 0.00192 | 0.00201 | 4.40 |
| 0.00196 | 0.00200 | 0.00191 | 0.00188 | 0.00199 |  |
| Cr | 0.00262 | 0.00263 | 0.00269 | 0.00268 | 0.00262 | 0.00246 | 0.00265 | 3.85 |
| 0.00249 | 0.00263 | 0.00282 | 0.00276 | 0.00273 |  |
| Tl | 0.00229 | 0.00225 | 0.00252 | 0.00254 | 0.00233 | 0.00228 | 0.00237 | 4.11 |
| 0.00233 | 0.00244 | 0.00236 | 0.00246 | 0.00228 |  |

试料4#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00547 | 0.00508 | 0.00541 | 0.00581 | 0.00523 | 0.00538 | 0.00540 | 4.04 |
| 0.00521 | 0.00557 | 0.00519 | 0.00537 | 0.00573 |  |
| Al | 0.00577 | 0.00533 | 0.00569 | 0.00522 | 0.00513 | 0.00545 | 0.00543 | 4.31 |
| 0.00543 | 0.00503 | 0.00573 | 0.00539 | 0.00556 |  |
| Pb | 0.00520 | 0.00498 | 0.00533 | 0.00495 | 0.00498 | 0.00543 | 0.00499 | 4.75 |
| 0.00479 | 0.00501 | 0.00478 | 0.00463 | 0.00477 |  |
| Ni | 0.00467 | 0.00492 | 0.00453 | 0.00467 | 0.00456 | 0.00462 | 0.00465 | 2.40 |
| 0.00472 | 0.00461 | 0.00462 | 0.00471 | 0.00448 |  |
| Cu | 0.00516 | 0.00486 | 0.00503 | 0.00500 | 0.00503 | 0.00502 | 0.00499 | 3.03 |
| 0.00481 | 0.00480 | 0.00516 | 0.00519 | 0.00477 |  |
| Cd | 0.00452 | 0.00451 | 0.00432 | 0.00438 | 0.00442 | 0.00424 | 0.00442 | 2.53 |
| 0.00462 | 0.00451 | 0.00428 | 0.00445 | 0.00434 |  |
| Cr | 0.00594 | 0.00603 | 0.00566 | 0.00561 | 0.00603 | 0.00608 | 0.00591 | 3.06 |
| 0.00571 | 0.00577 | 0.00609 | 0.00597 | 0.00614 |  |
| Tl | 0.00505 | 0.00470 | 0.00471 | 0.00509 | 0.00514 | 0.00506 | 0.00485 | 3.83 |
| 0.00461 | 0.00482 | 0.00469 | 0.00473 | 0.00474 |  |

试料5#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00837 | 0.00806 | 0.00775 | 0.00837 | 0.00820 | 0.00842 | 0.00807 | 3.56 |
| 0.00788 | 0.00764 | 0.00812 | 0.00833 | 0.00763 |  |
| Al | 0.00723 | 0.00721 | 0.00722 | 0.00809 | 0.00737 | 0.00712 | 0.00740 | 3.38 |
| 0.00746 | 0.00732 | 0.00742 | 0.00756 | 0.00741 |  |
| Pb | 0.00697 | 0.00715 | 0.00699 | 0.00686 | 0.00721 | 0.00706 | 0.00724 | 3.48 |
| 0.00752 | 0.00773 | 0.00733 | 0.00742 | 0.00738 |  |
| Ni | 0.00730 | 0.00786 | 0.00752 | 0.00697 | 0.00752 | 0.00773 | 0.00748 | 3.29 |
| 0.00783 | 0.00729 | 0.00746 | 0.00740 | 0.00745 |  |
| Cu | 0.00804 | 0.00768 | 0.00802 | 0.00766 | 0.00763 | 0.00780 | 0.00763 | 3.09 |
| 0.00734 | 0.00762 | 0.00739 | 0.00743 | 0.00735 |  |
| Cd | 0.00704 | 0.00711 | 0.00677 | 0.00721 | 0.00723 | 0.00726 | 0.00715 | 2.36 |
| 0.00731 | 0.00724 | 0.00706 | 0.00701 | 0.00742 |  |
| Cr | 0.00871 | 0.00846 | 0.00878 | 0.00831 | 0.00860 | 0.00842 | 0.00863 | 2.45 |
| 0.00858 | 0.00854 | 0.00905 | 0.00853 | 0.00893 |  |
| Tl | 0.00772 | 0.00819 | 0.00804 | 0.00786 | 0.00792 | 0.00779 | 0.00791 | 1.97 |
| 0.00770 | 0.00785 | 0.00780 | 0.00801 | 0.00813 |  |

试料6#

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.0103 | 0.0107 | 0.0109 | 0.0110 | 0.0115 | 0.0114 | 0.0110 | 3.08 |
| 0.0108 | 0.0112 | 0.0107 | 0.0110 | 0.0113 |  |
| Al | 0.00997 | 0.0103 | 0.0104 | 0.00990 | 0.0102 | 0.00969 | 0.0101 | 2.93 |
| 0.0104 | 0.0105 | 0.00973 | 0.00976 | 0.00977 |  |
| Pb | 0.00836 | 0.00914 | 0.00920 | 0.00903 | 0.00923 | 0.00917 | 0.00901 | 3.13 |
| 0.00885 | 0.00914 | 0.00891 | 0.00939 | 0.00865 |  |
| Ni | 0.00936 | 0.00996 | 0.00950 | 0.00921 | 0.0100 | 0.00965 | 0.00948 | 2.89 |
| 0.00943 | 0.00922 | 0.00934 | 0.00946 | 0.00915 |  |
| Cu | 0.00990 | 0.0102 | 0.0104 | 0.0103 | 0.00980 | 0.00976 | 0.00987 | 2.94 |
| 0.00966 | 0.00964 | 0.00951 | 0.00954 | 0.00988 |  |
| Cd | 0.00948 | 0.00931 | 0.00942 | 0.00927 | 0.00910 | 0.00962 | 0.00945 | 2.41 |
| 0.0100 | 0.00962 | 0.00943 | 0.00929 | 0.00936 |  |
| Cr | 0.0111 | 0.0112 | 0.0109 | 0.0110 | 0.0105 | 0.0104 | 0.0108 | 2.80 |
| 0.0110 | 0.0102 | 0.0107 | 0.0110 | 0.0109 |  |
| Tl | 0.0100 | 0.00960 | 0.00981 | 0.00989 | 0.0102 | 0.00936 | 0.00975 | 2.56 |
| 0.00952 | 0.00983 | 0.00941 | 0.00972 | 0.00997 |  |

（4）一验单位广西壮族自治区地质矿产测试研究中心比对样品分析结果：

试料1#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.00052 | 0.00057 | 0.0005 | 0.00046 | 0.00046 | 0.00053 | 0.00047 | 0.00052 | 0.0006 | 0.0006 | 0.00062 | 0.00053 | 11.15 |
| Al | 0.00078 | 0.00071 | 0.00073 | 0.00071 | 0.00059 | 0.00072 | 0.00072 | 0.00071 | 0.00055 | 0.00065 | 0.00064 | 0.00068 | 9.96 |
| Pb | 0.00038 | 0.0004 | 0.00047 | 0.00047 | 0.00053 | 0.00045 | 0.00044 | 0.00046 | 0.00039 | 0.00048 | 0.00047 | 0.00045 | 10.03 |
| Ni | 0.0004 | 0.00043 | 0.00037 | 0.00043 | 0.00042 | 0.00044 | 0.00041 | 0.00039 | 0.00035 | 0.00047 | 0.00044 | 0.00041 | 8.2 |
| Cu | 0.00071 | 0.00055 | 0.00055 | 0.00061 | 0.0006 | 0.00068 | 0.00061 | 0.00056 | 0.00061 | 0.00052 | 0.00062 | 0.0006 | 9.47 |
| Cd | 0.00053 | 0.00044 | 0.00047 | 0.00056 | 0.00044 | 0.00045 | 0.00052 | 0.00052 | 0.00044 | 0.00046 | 0.00057 | 0.00049 | 10.2 |
| Cr | 0.00069 | 0.00063 | 0.00066 | 0.00065 | 0.00067 | 0.00068 | 0.00065 | 0.00065 | 0.00063 | 0.00067 | 0.00068 | 0.00066 | 3.22 |
| Tl | 0.00051 | 0.00051 | 0.00044 | 0.00051 | 0.00039 | 0.00042 | 0.00045 | 0.00041 | 0.00043 | 0.00045 | 0.00046 | 0.00045 | 9.29 |

试料2#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.00086 | 0.00092 | 0.00101 | 0.00092 | 0.00093 | 0.00093 | 0.00093 | 0.00094 | 0.00096 | 0.00102 | 0.00095 | 0.00094 | 4.51 |
| Al | 0.00119 | 0.00115 | 0.00103 | 0.0011 | 0.00123 | 0.00108 | 0.00118 | 0.00102 | 0.00102 | 0.00109 | 0.00117 | 0.00112 | 6.69 |
| Pb | 0.00111 | 0.00107 | 0.00103 | 0.0011 | 0.00104 | 0.00113 | 0.00103 | 0.00115 | 0.00114 | 0.00112 | 0.00114 | 0.0011 | 4.27 |
| Ni | 0.00077 | 0.00089 | 0.0007 | 0.00077 | 0.00079 | 0.00079 | 0.00093 | 0.00078 | 0.00076 | 0.0008 | 0.00085 | 0.0008 | 7.94 |
| Cu | 0.00112 | 0.00114 | 0.00114 | 0.00124 | 0.00099 | 0.00108 | 0.00105 | 0.00125 | 0.00126 | 0.00101 | 0.00109 | 0.00112 | 8.29 |
| Cd | 0.0008 | 0.00084 | 0.00087 | 0.00085 | 0.00083 | 0.00092 | 0.00076 | 0.00085 | 0.00091 | 0.0009 | 0.00092 | 0.00086 | 6.01 |
| Cr | 0.00121 | 0.00122 | 0.00124 | 0.00114 | 0.00122 | 0.00118 | 0.00122 | 0.00126 | 0.00118 | 0.00122 | 0.00108 | 0.0012 | 4.22 |
| Tl | 0.00097 | 0.0009 | 0.00084 | 0.00082 | 0.00079 | 0.00084 | 0.00081 | 0.00081 | 0.00086 | 0.00092 | 0.00082 | 0.00085 | 6.34 |

试料3#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.00261 | 0.00247 | 0.00237 | 0.00285 | 0.00276 | 0.00292 | 0.00249 | 0.0028 | 0.00274 | 0.00258 | 0.00272 | 0.00266 | 6.49 |
| Al | 0.00258 | 0.00246 | 0.00267 | 0.00233 | 0.00251 | 0.00226 | 0.00272 | 0.00249 | 0.00241 | 0.00241 | 0.00272 | 0.0025 | 6.1 |
| Pb | 0.00256 | 0.00211 | 0.00277 | 0.00258 | 0.00256 | 0.00237 | 0.00253 | 0.00257 | 0.00261 | 0.00235 | 0.0023 | 0.00248 | 7.42 |
| Ni | 0.0024 | 0.00223 | 0.00216 | 0.00221 | 0.00262 | 0.00251 | 0.00247 | 0.00245 | 0.00224 | 0.00232 | 0.00229 | 0.00236 | 6.15 |
| Cu | 0.00258 | 0.0024 | 0.00237 | 0.00226 | 0.00265 | 0.00255 | 0.00238 | 0.00275 | 0.00229 | 0.00273 | 0.00278 | 0.00252 | 7.54 |
| Cd | 0.00201 | 0.00208 | 0.00198 | 0.00194 | 0.00193 | 0.00193 | 0.00195 | 0.00192 | 0.00196 | 0.00195 | 0.00212 | 0.00198 | 3.36 |
| Cr | 0.00262 | 0.00253 | 0.00272 | 0.00273 | 0.00256 | 0.00253 | 0.00277 | 0.00241 | 0.00253 | 0.00261 | 0.00255 | 0.0026 | 4.12 |
| Tl | 0.00223 | 0.00244 | 0.00231 | 0.00232 | 0.00222 | 0.00224 | 0.00252 | 0.00257 | 0.00245 | 0.00218 | 0.00244 | 0.00236 | 5.69 |

试料4#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.00546 | 0.00512 | 0.00504 | 0.00519 | 0.00516 | 0.00523 | 0.00533 | 0.00511 | 0.00525 | 0.00567 | 0.0055 | 0.00528 | 3.65 |
| Al | 0.00574 | 0.00544 | 0.00538 | 0.00511 | 0.0052 | 0.00528 | 0.00552 | 0.00538 | 0.00504 | 0.00551 | 0.00537 | 0.00536 | 3.69 |
| Pb | 0.00489 | 0.00513 | 0.00503 | 0.00506 | 0.00512 | 0.00489 | 0.00515 | 0.00489 | 0.00531 | 0.00504 | 0.00503 | 0.00505 | 2.56 |
| Ni | 0.00466 | 0.00504 | 0.00483 | 0.00463 | 0.0046 | 0.00471 | 0.00468 | 0.0047 | 0.0048 | 0.00499 | 0.00484 | 0.00477 | 3.05 |
| Cu | 0.00471 | 0.00495 | 0.00508 | 0.00475 | 0.00509 | 0.00507 | 0.00529 | 0.00481 | 0.00499 | 0.00507 | 0.00503 | 0.00499 | 3.45 |
| Cd | 0.00428 | 0.00436 | 0.0043 | 0.00417 | 0.00406 | 0.00425 | 0.00424 | 0.00416 | 0.00438 | 0.00444 | 0.00449 | 0.00428 | 3 |
| Cr | 0.00576 | 0.00577 | 0.00603 | 0.00613 | 0.00585 | 0.00616 | 0.00613 | 0.00597 | 0.00615 | 0.00584 | 0.00613 | 0.00599 | 2.67 |
| Tl | 0.00475 | 0.00478 | 0.00499 | 0.00487 | 0.00489 | 0.00496 | 0.00476 | 0.00514 | 0.00508 | 0.00479 | 0.00489 | 0.0049 | 2.66 |

试料5#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.00811 | 0.00798 | 0.00776 | 0.00797 | 0.00794 | 0.00826 | 0.00771 | 0.00789 | 0.00814 | 0.00793 | 0.0077 | 0.00794 | 2.25 |
| Al | 0.00804 | 0.00795 | 0.00765 | 0.00773 | 0.00726 | 0.00751 | 0.00785 | 0.00766 | 0.00798 | 0.00762 | 0.0075 | 0.0077 | 3.08 |
| Pb | 0.00738 | 0.00715 | 0.00723 | 0.00743 | 0.00738 | 0.00737 | 0.00722 | 0.00709 | 0.00723 | 0.00743 | 0.0074 | 0.0073 | 1.65 |
| Ni | 0.00774 | 0.00755 | 0.00735 | 0.007 | 0.00759 | 0.00766 | 0.00757 | 0.00746 | 0.00732 | 0.00746 | 0.00727 | 0.00745 | 2.79 |
| Cu | 0.0077 | 0.00755 | 0.00774 | 0.00704 | 0.0073 | 0.00776 | 0.00736 | 0.00785 | 0.00735 | 0.00744 | 0.00723 | 0.00748 | 3.44 |
| Cd | 0.00701 | 0.00728 | 0.00688 | 0.00697 | 0.00687 | 0.007 | 0.00709 | 0.00681 | 0.00697 | 0.00722 | 0.00696 | 0.00701 | 2.03 |
| Cr | 0.00857 | 0.00837 | 0.00832 | 0.00854 | 0.00835 | 0.00853 | 0.00841 | 0.00859 | 0.0084 | 0.00854 | 0.00876 | 0.00849 | 1.56 |
| Tl | 0.00743 | 0.00768 | 0.00781 | 0.0079 | 0.00796 | 0.00802 | 0.00803 | 0.00749 | 0.00804 | 0.00778 | 0.0082 | 0.00785 | 3.05 |

试料6#

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | | | | | | 平均值 | RSD % |
| Fe | 0.01065 | 0.01034 | 0.00986 | 0.0098 | 0.01028 | 0.0107 | 0.00996 | 0.01003 | 0.0098 | 0.00996 | 0.01077 | 0.0102 | 3.65 |
| Al | 0.01055 | 0.01029 | 0.01023 | 0.01064 | 0.01079 | 0.01081 | 0.00989 | 0.00963 | 0.01052 | 0.00982 | 0.01045 | 0.01033 | 3.85 |
| Pb | 0.00883 | 0.00884 | 0.00866 | 0.009 | 0.00911 | 0.00892 | 0.00904 | 0.00898 | 0.00898 | 0.00903 | 0.00917 | 0.00896 | 1.6 |
| Ni | 0.01002 | 0.00986 | 0.00978 | 0.00996 | 0.00926 | 0.00979 | 0.00956 | 0.0095 | 0.01004 | 0.00919 | 0.00976 | 0.0097 | 3 |
| Cu | 0.00995 | 0.0095 | 0.00993 | 0.01019 | 0.0097 | 0.00994 | 0.00991 | 0.00993 | 0.01047 | 0.00991 | 0.00982 | 0.00993 | 2.49 |
| Cd | 0.00951 | 0.0096 | 0.00961 | 0.00941 | 0.00978 | 0.0099 | 0.00933 | 0.00955 | 0.00973 | 0.00922 | 0.00983 | 0.00959 | 2.23 |
| Cr | 0.01016 | 0.01019 | 0.01011 | 0.01012 | 0.01018 | 0.01016 | 0.01022 | 0.0104 | 0.01078 | 0.01082 | 0.01003 | 0.01029 | 2.61 |
| Tl | 0.00964 | 0.00946 | 0.00967 | 0.00946 | 0.00955 | 0.00923 | 0.00979 | 0.00953 | 0.00998 | 0.00969 | 0.00957 | 0.0096 | 2.02 |

（5）一验单位北矿检测技术有限公司比对样品分析结果：

试料1#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00071 | 0.00080 | 0.00065 | 0.00052 | 0.00071 | 0.00056 | 0.00066 | 14.44 |
| 0.00066 |  |  |  |  |  |
| Al | 0.00049 | 0.00052 | 0.00066 | 0.00084 | 0.00075 | 0.00050 | 0.00063 | 21.39 |
| 0.00063 |  |  |  |  |  |
| Pb | 0.00032 | 0.00048 | 0.00042 | 0.00052 | 0.00045 | 0.00038 | 0.00043 | 15.37 |
| 0.00046 |  |  |  |  |  |
| Ni | 0.00030 | 0.00052 | 0.00041 | 0.00039 | 0.00044 | 0.00036 | 0.00040 | 16.98 |
| 0.00039 |  |  |  |  |  |
| Cu | 0.00073 | 0.00053 | 0.00060 | 0.00058 | 0.00061 | 0.00072 | 0.00061 | 13.32 |
| 0.00053 |  |  |  |  |  |
| Cd | 0.00046 | 0.00050 | 0.00062 | 0.00055 | 0.00049 | 0.00059 | 0.00054 | 10.62 |
| 0.00055 |  |  |  |  |  |
| Cr | 0.00074 | 0.00061 | 0.00073 | 0.00074 | 0.00080 | 0.00063 | 0.00071 | 9.41 |
| 0.00072 |  |  |  |  |  |
| Tl | 0.00044 | 0.00051 | 0.00055 | 0.00034 | 0.00042 | 0.00048 | 0.00044 | 16.89 |
| 0.00037 |  |  |  |  |  |

试料2#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00102 | 0.00091 | 0.00103 | 0.00096 | 0.00090 | 0.00087 | 0.00096 | 7.43 |
| 0.00105 |  |  |  |  |  |
| Al | 0.00138 | 0.00120 | 0.00112 | 0.00128 | 0.00131 | 0.00106 | 0.00123 | 9.02 |
| 0.00125 |  |  |  |  |  |
| Pb | 0.00117 | 0.00115 | 0.00109 | 0.00102 | 0.00096 | 0.00097 | 0.00104 | 9.86 |
| 0.00090 |  |  |  |  |  |
| Ni | 0.00080 | 0.00092 | 0.00095 | 0.00085 | 0.00107 | 0.00114 | 0.00096 | 12.36 |
| 0.00096 |  |  |  |  |  |
| Cu | 0.00112 | 0.00117 | 0.00103 | 0.00096 | 0.00106 | 0.00101 | 0.00104 | 8.38 |
| 0.00092 |  |  |  |  |  |
| Cd | 0.00095 | 0.00102 | 0.00107 | 0.00096 | 0.00110 | 0.00101 | 0.00100 | 7.00 |
| 0.00090 |  |  |  |  |  |
| Cr | 0.00133 | 0.00109 | 0.00118 | 0.00108 | 0.00121 | 0.00126 | 0.00118 | 7.84 |
| 0.00112 |  |  |  |  |  |
| Tl | 0.00104 | 0.00090 | 0.00097 | 0.00087 | 0.00104 | 0.00105 | 0.00097 | 7.85 |
| 0.00091 |  |  |  |  |  |

试料3#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00250 | 0.00253 | 0.00239 | 0.00248 | 0.00222 | 0.00266 | 0.00248 | 5.68 |
| 0.00257 |  |  |  |  |  |
| Al | 0.00228 | 0.00226 | 0.00245 | 0.00218 | 0.00241 | 0.00236 | 0.00233 | 4.15 |
| 0.00240 |  |  |  |  |  |
| Pb | 0.00282 | 0.00267 | 0.00267 | 0.00253 | 0.00265 | 0.00272 | 0.00266 | 3.79 |
| 0.00254 |  |  |  |  |  |
| Ni | 0.00240 | 0.00262 | 0.00236 | 0.00253 | 0.00257 | 0.00261 | 0.00249 | 5.10 |
| 0.00231 |  |  |  |  |  |
| Cu | 0.00260 | 0.00271 | 0.00250 | 0.00247 | 0.00266 | 0.00257 | 0.00259 | 3.25 |
| 0.00260 |  |  |  |  |  |
| Cd | 0.00234 | 0.00220 | 0.00230 | 0.00234 | 0.00213 | 0.00218 | 0.00225 | 3.68 |
| 0.00228 |  |  |  |  |  |
| Cr | 0.00212 | 0.00223 | 0.00239 | 0.00243 | 0.00222 | 0.00226 | 0.00226 | 4.87 |
| 0.00219 |  |  |  |  |  |
| Tl | 0.00264 | 0.00251 | 0.00242 | 0.00254 | 0.00249 | 0.00258 | 0.00252 | 3.14 |
| 0.00243 |  |  |  |  |  |

试料4#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00496 | 0.00523 | 0.00537 | 0.00525 | 0.00563 | 0.00538 | 0.00532 | 3.92 |
| 0.00545 |  |  |  |  |  |
| Al | 0.00587 | 0.00540 | 0.00579 | 0.00592 | 0.00552 | 0.00545 | 0.00565 | 3.69 |
| 0.00563 |  |  |  |  |  |
| Pb | 0.00481 | 0.00473 | 0.00453 | 0.00495 | 0.00523 | 0.00549 | 0.00506 | 8.36 |
| 0.00569 |  |  |  |  |  |
| Ni | 0.00507 | 0.004726 | 0.00482 | 0.00493 | 0.00468 | 0.00492 | 0.00488 | 2.98 |
| 0.00502 |  |  |  |  |  |
| Cu | 0.00538 | 0.00496 | 0.00532 | 0.00527 | 0.00483 | 0.00492 | 0.00510 | 4.30 |
| 0.00501 |  |  |  |  |  |
| Cd | 0.00482 | 0.00471 | 0.00438 | 0.00446 | 0.00472 | 0.00466 | 0.00462 | 3.35 |
| 0.00459 |  |  |  |  |  |
| Cr | 0.00544 | 0.00634 | 0.00576 | 0.00582 | 0.00620 | 0.00617 | 0.00596 | 5.21 |
| 0.00601 |  |  |  |  |  |
| Tl | 0.00505 | 0.00480 | 0.00464 | 0.00479 | 0.00502 | 0.00461 | 0.00483 | 3.54 |
| 0.00489 |  |  |  |  |  |

试料5#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.00812 | 0.00836 | 0.00805 | 0.00787 | 0.00847 | 0.00842 | 0.00817 | 3.01 |
| 0.00791 |  |  |  |  |  |
| Al | 0.00814 | 0.00826 | 0.00775 | 0.00820 | 0.00738 | 0.00787 | 0.00789 | 4.15 |
| 0.00763 |  |  |  |  |  |
| Pb | 0.00737 | 0.00709 | 0.00752 | 0.00691 | 0.00675 | 0.00736 | 0.00720 | 4.02 |
| 0.00742 |  |  |  |  |  |
| Ni | 0.00782 | 0.00806 | 0.00777 | 0.00792 | 0.00765 | 0.00751 | 0.00781 | 2.44 |
| 0.00797 |  |  |  |  |  |
| Cu | 0.00734 | 0.00728 | 0.00802 | 0.00776 | 0.00756 | 0.00788 | 0.00763 | 3.57 |
| 0.00759 |  |  |  |  |  |
| Cd | 0.00761 | 0.00731 | 0.00707 | 0.00721 | 0.00732 | 0.00705 | 0.00730 | 2.97 |
| 0.00755 |  |  |  |  |  |
| Cr | 0.00794 | 0.00788 | 0.00774 | 0.00807 | 0.00837 | 0.00840 | 0.00810 | 3.17 |
| 0.00827 |  |  |  |  |  |
| Tl | 0.00785 | 0.00740 | 0.00830 | 0.00821 | 0.00765 | 0.00811 | 0.00792 | 4.04 |
| 0.00791 |  |  |  |  |  |

试料6#的精密度

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值 % | | | | | | 平均值% | RSD % |
| Fe | 0.0109 | 0.0103 | 0.0103 | 0.0115 | 0.0100 | 0.0114 | 0.0107 | 5.34 |
| 0.0108 |  |  |  |  |  |
| Al | 0.00997 | 0.0103 | 0.0112 | 0.00990 | 0.0102 | 0.0104 | 0.0104 | 4.77 |
| 0.0110 |  |  |  |  |  |
| Pb | 0.0103 | 0.00934 | 0.00897 | 0.00939 | 0.00965 | 0.00914 | 0.00940 | 4.90 |
| 0.00902 |  |  |  |  |  |
| Ni | 0.00988 | 0.0102 | 0.00967 | 0.00982 | 0.0101 | 0.00998 | 0.00991 | 1.95 |
| 0.00973 |  |  |  |  |  |
| Cu | 0.00944 | 0.0101 | 0.0101 | 0.0103 | 0.00962 | 0.00964 | 0.00986 | 3.19 |
| 0.00982 |  |  |  |  |  |
| Cd | 0.0100 | 0.00981 | 0.00965 | 0.00960 | 0.00938 | 0.00926 | 0.00963 | 2.60 |
| 0.00970 |  |  |  |  |  |
| Cr | 0.0114 | 0.0112 | 0.0107 | 0.0103 | 0.0105 | 0.0104 | 0.0108 | 3.83 |
| 0.0108 |  |  |  |  |  |
| Tl | 0.0100 | 0.00965 | 0.00998 | 0.00973 | 0.00961 | 0.00963 | 0.00969 | 2.62 |
| 0.00925 |  |  |  |  |  |

**（6）**二验单位广东先导稀材股份有限公司比对样品分析结果：

试料1#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00072 0.00069 0.00074 0.00068 0.00072 0.00071  0.00063 0.00066 0.00080 0.00085 0.00072 | 0.00072 | 8.16 |
| Cd | 0.00045 0.00042 0.00048 0.00043 0.00039 0.00043  0.00045 0.00047 0.00048 0.00043 0.00040 | 0.00044 | 6.55 |
| Cu | 0.00058 0.00060 0.00061 0.00059 0.00065 0.00056  0.00062 0.00059 0.00057 0.00067 0.00055 | 0.00060 | 5.85 |
| Fe | 0.00065 0.00060 0.00061 0.00068 0.00065 0.00059  0.00065 0.00052 0.00064 0.00059 0.00053 | 0.00061 | 7.97 |
| Ni | 0.00053 0.00048 0.00043 0.00040 0.00052 0.00046  0.00050 0.00045 0.00043 0.00047 0.00046 | 0.00047 | 8.09 |
| Pb | 0.00053 0.00045 0.00050 0.00060 0.00052 0.00051  0.00048 0.00051 0.00050 0.00056 0.00048 | 0.00051 | 7.58 |
| Tl | 0.00039 0.00043 0.00049 0.00045 0.00039 0.00047  0.00042 0.00045 0.00051 0.00044 0.00046 | 0.00045 | 7.43 |
| Cr | 0.00071 0.00070 0.00068 0.00064 0.00064 0.00067  0.00066 0.00067 0.00062 0.00063 0.00072 | 0.00067 | 4.74 |

试料2#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00126 0.00112 0.00119 0.00110 0.00115 0.00106  0.00104 0.00125 0.00109 0.00107 0.00120 | 0.00114 | 6.40 |
| Cd | 0.00083 0.00085 0.00094 0.00088 0.00090 0.00084  0.00081 0.00082 0.00078 0.00084 0.00089 | 0.00085 | 5.13 |
| Cu | 0.00109 0.00115 0.00112 0.00109 0.00118 0.00110  0.00103 0.00093 0.00110 0.00109 0.00107 | 0.00109 | 5.08 |
| Fe | 0.00102 0.00105 0.00090 0.00108 0.00115 0.00112  0.00100 0.00099 0.00108 0.00104 0.00106 | 0.00104 | 6.20 |
| Ni | 0.00080 0.00076 0.00085 0.00094 0.00091 0.00082  0.00086 0.00085 0.00084 0.00079 0.00089 | 0.00082 | 4.58 |
| Pb | 0.00089 0.00096 0.00100 0.00105 0.00101 0.00095  0.00112 0.00096 0.00099 0.00090 0.00103 | 0.00099 | 6.41 |
| Tl | 0.00086 0.00085 0.00079 0.00080 0.00092 0.00086  0.00090 0.00078 0.00086 0.00079 0.00084 | 0.00084 | 5.26 |
| Cr | 0.00112 0.00121 0.00105 0.00119 0.00116 0.00118  0.00110 0.00123 0.00117 0.00111 0.00109 | 0.00115 | 4.66 |

试料3#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00256 0.00218 0.00240 0.00256 0.00261 0.00248  0.00265 0.00257 0.00221 0.00235 0.00261 | 0.00247 | 6.33 |
| Cd | 0.00190 0.00181 0.00185 0.00198 0.00209 0.00201  0.00200 0.00201 0.00207 0.00199 0.00187 | 0.00196 | 4.41 |
| Cu | 0.00246 0.00238 0.00240 0.00256 0.00261 0.00248  0.00265 0.00257 0.00221 0.00245 0.00255 | 0.00248 | 4.80 |
| Fe | 0.00262 0.00239 0.00265 0.00253 0.00260 0.00258  0.00234 0.00225 0.00257 0.00286 0.00260 | 0.00254 | 6.24 |
| Ni | 0.00190 0.00201 0.00225 0.00198 0.00219 0.00221  0.00200 0.00208 0.00207 0.00199 0.00227 | 0.00208 | 5.73 |
| Pb | 0.00220 0.00231 0.00225 0.00228 0.00219 0.00221  0.00260 0.00238 0.00239 0.00247 0.00227 | 0.00232 | 5.22 |
| Tl | 0.00203 0.00212 0.00225 0.00228 0.00219 0.00221  0.00220 0.00208 0.00207 0.00229 0.00227 | 0.00218 | 4.02 |
| Cr | 0.00262 0.00279 0.00265 0.00282 0.00260 0.00258  0.00274 0.00269 0.00276 0.00286 0.00240 | 0.00268 | 4.68 |

试料4#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00529 0.00466 0.00518 0.00512 0.00508 0.00526  0.00539 0.00547 0.00519 0.00538 0.00560 | 0.00524 | 4.49 |
| Cd | 0.00402 0.00422 0.00415 0.00446 0.00412 0.00453  0.00439 0.00431 0.00443 0.00417 0.00428 | 0.00428 | 3.57 |
| Cu | 0.00487 0.00466 0.00501 0.00471 0.00465 0.00493  0.00508 0.00469 0.00534 0.00468 0.00502 | 0.00488 | 4.36 |
| Fe | 0.00509 0.00573 0.00504 0.00551 0.00528 0.00534  0.00518 0.00547 0.00519 0.00567 0.00558 | 0.00537 | 4.19 |
| Ni | 0.00425 0.00451 0.00442 0.00478 0.00485 0.00460  0.00468 0.00475 0.00486 0.00449 0.00457 | 0.00463 | 3.95 |
| Pb | 0.00487 0.00475 0.00480 0.00445 0.00476 0.00491  0.00509 0.00503 0.00439 0.00467 0.00469 | 0.00476 | 4.50 |
| Tl | 0.00475 0.00487 0.00504 0.00501 0.00457 0.00491  0.00509 0.00503 0.00469 0.00457 0.00469 | 0.00484 | 3.80 |
| Cr | 0.00601 0.00587 0.00567 0.00576 0.00520 0.00524  0.00576 0.00572 0.00578 0.00547 0.00565 | 0.00565 | 4.23 |

试料5#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00743 0.00772 0.00748 0.00780 0.00769 0.00727  0.00768 0.00732 0.00731 0.00718 0.00732 | 0.00747 | 2.74 |
| Cd | 0.00722 0.00706 0.00698 0.00674 0.00694 0.00733  0.00694 0.00664 0.00678 0.00710 0.00715 | 0.00699 | 2.88 |
| Cu | 0.00774 0.00768 0.00726 0.00746 0.00735 0.00738  0.00785 0.00723 0.00786 0.00755 0.00760 | 0.00754 | 2.84 |
| Fe | 0.00798 0.00832 0.00824 0.00811 0.00818 0.00809  0.00845 0.00851 0.00769 0.00805 0.00796 | 0.00814 | 2.74 |
| Ni | 0.00699 0.00708 0.00728 0.00735 0.00712 0.00724  0.00701 0.00785 0.00697 0.00741 0.00728 | 0.00723 | 3.35 |
| Pb | 0.00778 0.00685 0.00702 0.00732 0.00748 0.00738  0.00684 0.00704 0.00695 0.00724 0.00739 | 0.00721 | 3.90 |
| Tl | 0.00794 0.00812 0.00805 0.00814 0.00768 0.00812  0.00773 0.00803 0.00771 0.00745 0.00828 | 0.00793 | 3.05 |
| Cr | 0.00822 0.00886 0.00865 0.00825 0.00847 0.00839  0.00882 0.00846 0.00860 0.00847 0.00857 | 0.00852 | 2.29 |

试料6#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.0103 0.0108 0.0105 0.00995 0.00987 0.0103  0.0102 0.0105 0.0104 0.0105 0.0106 | 0.0104 | 2.53 |
| Cd | 0.00942 0.00933 0.00895 0.00920 0.00928 0.00945  0.00963 0.00943 0.00913 0.00906 0.00938 | 0.00930 | 2.02 |
| Cu | 0.00962 0.00988 0.00976 0.00958 0.00969 0.00954  0.0103 0.00976 0.00944 0.0101 0.00969 | 0.00976 | 2.46 |
| Fe | 0.0103 0.0110 0.0105 0.0106 0.0107 0.0104  0.0106 0.0113 0.0104 0.0107 0.0106 | 0.0106 | 2.58 |
| Ni | 0.00898 0.00884 0.00924 0.00906 0.00966 0.00932  0.00921 0.00935 0.00951 0.00895 0.00969 | 0.00926 | 2.94 |
| Pb | 0.00915 0.00903 0.00912 0.00857 0.0876 0.00915  0.00903 0.00865 0.00927 0.00887 0.00938 | 0.00900 | 2.72 |
| Tl | 0.00972 0.00935 0.00975 0.00915 0.00903 0.00954  0.00927 0.00938 0.00924 0.00903 0.00927 | 0.00934 | 2.51 |
| Cr | 0.0108 0.0110 0.0105 0.0106 0.0107 0.0104  0.0106 0.0103 0.0104 0.0107 0.0106 | 0.0106 | 1.80 |

**（7）**二验单位洛阳晶联光电材料有限责任公司比对样品分析结果：

试料1#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00058 | 0.00046 | 0.00059 | 0.00046 | 0.00049 | 0.00053 | 0.00065 | 0.00051 | 0.00056 | 0.00054 | 11.25 |
| Al | 0.00072 | 0.00069 | 0.00064 | 0.00068 | 0.00072 | 0.00061 | 0.00063 | 0.00066 | 0.00080 | 0.00068 | 8.02 |
| Pb | 0.00045 | 0.00039 | 0.00044 | 0.00038 | 0.00043 | 0.00046 | 0.00042 | 0.00039 | 0.00049 | 0.00043 | 8.08 |
| Ni | 0.00042 | 0.00041 | 0.00046 | 0.00043 | 0.00042 | 0.00039 | 0.00046 | 0.00044 | 0.00036 | 0.00042 | 7.21 |
| Cu | 0.00055 | 0.00051 | 0.00065 | 0.00056 | 0.00061 | 0.00062 | 0.00054 | 0.00053 | 0.00052 | 0.00057 | 8.21 |
| Cd | 0.00045 | 0.00042 | 0.00048 | 0.00043 | 0.00039 | 0.00043 | 0.00045 | 0.00047 | 0.00048 | 0.00044 | 6.37 |
| Cr | 0.00073 | 0.00071 | 0.00065 | 0.00058 | 0.00073 | 0.00066 | 0.00064 | 0.00063 | 0.00065 | 0.00066 | 7.10 |
| Tl | 0.00047 | 0.00049 | 0.00045 | 0.00042 | 0.00039 | 0.00045 | 0.00044 | 0.00043 | 0.00051 | 0.00045 | 7.63 |

试料2#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00084 | 0.00096 | 0.00091 | 0.00098 | 0.00099 | 0.00099 | 0.00106 | 0.00097 | 0.00085 | 0.00095 | 7.05 |
| Al | 0.00125 | 0.00119 | 0.00129 | 0.00113 | 0.00105 | 0.00126 | 0.00124 | 0.00109 | 0.00126 | 0.00120 | 6.76 |
| Pb | 0.00099 | 0.00096 | 0.00116 | 0.00105 | 0.00101 | 0.00106 | 0.00112 | 0.00103 | 0.00090 | 0.00103 | 7.24 |
| Ni | 0.00080 | 0.00096 | 0.00082 | 0.00097 | 0.00091 | 0.00091 | 0.00080 | 0.00085 | 0.00082 | 0.00087 | 7.31 |
| Cu | 0.00109 | 0.00114 | 0.00109 | 0.00102 | 0.00097 | 0.00103 | 0.00113 | 0.00096 | 0.00098 | 0.00105 | 6.23 |
| Cd | 0.00081 | 0.00083 | 0.00080 | 0.00094 | 0.00093 | 0.00090 | 0.00091 | 0.00082 | 0.00089 | 0.00087 | 5.94 |
| Cr | 0.00110 | 0.00106 | 0.00113 | 0.00126 | 0.00107 | 0.00121 | 0.00122 | 0.00106 | 0.00123 | 0.00115 | 6.65 |
| Tl | 0.00086 | 0.00097 | 0.00081 | 0.00080 | 0.00092 | 0.00086 | 0.00090 | 0.00094 | 0.00086 | 0.00088 | 6.13 |

试料3#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00279 | 0.00266 | 0.00234 | 0.00279 | 0.00273 | 0.00236 | 0.00239 | 0.00265 | 0.00269 | 0.00260 | 6.69 |
| Al | 0.00232 | 0.00239 | 0.00269 | 0.00253 | 0.00249 | 0.00261 | 0.00221 | 0.00225 | 0.00257 | 0.00245 | 6.43 |
| Pb | 0.00253 | 0.00249 | 0.00261 | 0.00221 | 0.00246 | 0.00258 | 0.00232 | 0.00256 | 0.00221 | 0.00244 | 6.02 |
| Ni | 0.00231 | 0.00221 | 0.00225 | 0.00207 | 0.00219 | 0.00221 | 0.00200 | 0.00196 | 0.00190 | 0.00212 | 6.38 |
| Cu | 0.00269 | 0.00253 | 0.00249 | 0.00261 | 0.00251 | 0.00225 | 0.00233 | 0.00246 | 0.00251 | 0.00249 | 5.03 |
| Cd | 0.00208 | 0.00193 | 0.00208 | 0.00189 | 0.00189 | 0.00203 | 0.00187 | 0.00181 | 0.00190 | 0.00194 | 4.72 |
| Cr | 0.00249 | 0.00269 | 0.00267 | 0.00279 | 0.00273 | 0.00236 | 0.00239 | 0.00265 | 0.00269 | 0.00261 | 5.57 |
| Tl | 0.00221 | 0.00245 | 0.00237 | 0.00219 | 0.00221 | 0.00240 | 0.00216 | 0.00209 | 0.00234 | 0.00227 | 5.14 |

试料4#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00509 | 0.00576 | 0.00504 | 0.00539 | 0.00481 | 0.00539 | 0.00526 | 0.00547 | 0.00579 | 0.00533 | 5.73 |
| Al | 0.00529 | 0.00466 | 0.00534 | 0.00539 | 0.00573 | 0.00526 | 0.00539 | 0.00545 | 0.00569 | 0.00536 | 5.43 |
| Pb | 0.00487 | 0.00469 | 0.00534 | 0.00531 | 0.00476 | 0.00526 | 0.00509 | 0.00503 | 0.00467 | 0.00500 | 5.02 |
| Ni | 0.00482 | 0.00469 | 0.00464 | 0.00459 | 0.00453 | 0.00472 | 0.00446 | 0.00454 | 0.00476 | 0.00464 | 2.41 |
| Cu | 0.00466 | 0.00487 | 0.00456 | 0.00472 | 0.00465 | 0.00493 | 0.00489 | 0.00455 | 0.00448 | 0.00470 | 3.27 |
| Cd | 0.00433 | 0.00423 | 0.00415 | 0.00446 | 0.00452 | 0.00453 | 0.00439 | 0.00432 | 0.00433 | 0.00437 | 2.77 |
| Cr | 0.00607 | 0.00584 | 0.00574 | 0.00596 | 0.00564 | 0.00529 | 0.00576 | 0.00572 | 0.00574 | 0.00575 | 3.57 |
| Tl | 0.00487 | 0.00469 | 0.00504 | 0.00531 | 0.00476 | 0.00506 | 0.00509 | 0.00503 | 0.00477 | 0.00496 | 3.79 |

试料5#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00832 | 0.00798 | 0.00815 | 0.00876 | 0.00803 | 0.00809 | 0.00843 | 0.00794 | 0.00769 | 0.00815 | 3.61 |
| Al | 0.00772 | 0.00743 | 0.00716 | 0.00803 | 0.00769 | 0.00731 | 0.00746 | 0.00732 | 0.00731 | 0.00749 | 3.42 |
| Pb | 0.00746 | 0.00708 | 0.00732 | 0.00769 | 0.00754 | 0.00721 | 0.00703 | 0.00719 | 0.00734 | 0.00732 | 2.79 |
| Ni | 0.00712 | 0.00726 | 0.00769 | 0.00768 | 0.00744 | 0.00723 | 0.00754 | 0.00733 | 0.00740 | 0.00741 | 2.52 |
| Cu | 0.00774 | 0.00772 | 0.00726 | 0.00746 | 0.00735 | 0.00744 | 0.00769 | 0.00723 | 0.00786 | 0.00753 | 2.88 |
| Cd | 0.00722 | 0.00706 | 0.00689 | 0.00698 | 0.00694 | 0.00733 | 0.00694 | 0.00733 | 0.00720 | 0.00708 | 2.02 |
| Cr | 0.00822 | 0.00886 | 0.00835 | 0.00889 | 0.00847 | 0.00839 | 0.00882 | 0.00846 | 0.00855 | 0.00856 | 2.68 |
| Tl | 0.00794 | 0.00812 | 0.00803 | 0.00776 | 0.00815 | 0.00812 | 0.00773 | 0.00803 | 0.00759 | 0.00794 | 2.39 |

试料6#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.0111 | 0.0112 | 0.0106 | 0.0105 | 0.0106 | 0.0103 | 0.0106 | 0.0112 | 0.0113 | 0.0108 | 2.70 |
| Al | 0.0103 | 0.0108 | 0.0106 | 0.0102 | 0.0106 | 0.0104 | 0.0103 | 0.0101 | 0.0112 | 0.0105 | 3.08 |
| Pb | 0.00915 | 0.00903 | 0.00879 | 0.00927 | 0.00932 | 0.00915 | 0.00903 | 0.00979 | 0.00927 | 0.00920 | 2.81 |
| Ni | 0.00948 | 0.00952 | 0.00913 | 0.00906 | 0.00966 | 0.00932 | 0.00955 | 0.00959 | 0.00951 | 0.00942 | 2.09 |
| Cu | 0.00962 | 0.00993 | 0.00975 | 0.00943 | 0.00969 | 0.00954 | 0.0101 | 0.00998 | 0.00944 | 0.00972 | 2.33 |
| Cd | 0.00942 | 0.00933 | 0.00915 | 0.00966 | 0.00943 | 0.00952 | 0.00963 | 0.00943 | 0.00913 | 0.00941 | 1.86 |
| Cr | 0.0112 | 0.0106 | 0.0103 | 0.0105 | 0.0111 | 0.0102 | 0.0106 | 0.0105 | 0.0109 | 0.0107 | 3.04 |
| Tl | 0.00972 | 0.00963 | 0.00975 | 0.00943 | 0.00969 | 0.00954 | 0.00932 | 0.00938 | 0.00934 | 0.00953 | 1.69 |

**（8）**二验单位南宁奥博斯检测科技有限责任公司比对样品分析结果：

试料1#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00058 | 0.00076 | 0.00059 | 0.00066 | 0.00049 | 0.00053 | 0.00063 | 0.00071 | 0.00056 | 0.00064 | 13.33 |
| Al | 0.00072 | 0.00079 | 0.00064 | 0.00068 | 0.00072 | 0.00081 | 0.00063 | 0.00066 | 0.00080 | 0.00072 | 9.19 |
| Pb | 0.00050 | 0.00039 | 0.00048 | 0.00038 | 0.00043 | 0.00046 | 0.00042 | 0.00049 | 0.00049 | 0.00045 | 9.54 |
| Ni | 0.00042 | 0.00041 | 0.00046 | 0.00053 | 0.00052 | 0.00049 | 0.00046 | 0.00044 | 0.00046 | 0.00047 | 8.36 |
| Cu | 0.00055 | 0.00051 | 0.00049 | 0.00056 | 0.00061 | 0.00062 | 0.00054 | 0.00053 | 0.00052 | 0.00055 | 7.49 |
| Cd | 0.00039 | 0.00038 | 0.00044 | 0.00046 | 0.00043 | 0.00043 | 0.00045 | 0.00042 | 0.00048 | 0.00043 | 6.95 |
| Cr | 0.00069 | 0.00071 | 0.00065 | 0.00058 | 0.00053 | 0.00066 | 0.00064 | 0.00063 | 0.00065 | 0.00064 | 8.06 |
| Tl | 0.00037 | 0.00049 | 0.00041 | 0.00042 | 0.00039 | 0.00045 | 0.00044 | 0.00043 | 0.00041 | 0.00042 | 7.79 |

试料2#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00080 | 0.00096 | 0.00101 | 0.00098 | 0.00099 | 0.00099 | 0.00096 | 0.00097 | 0.00080 | 0.00094 | 8.12 |
| Al | 0.00115 | 0.00119 | 0.00129 | 0.00103 | 0.00105 | 0.00123 | 0.00124 | 0.00119 | 0.00127 | 0.00118 | 7.28 |
| Pb | 0.00091 | 0.00096 | 0.00116 | 0.00105 | 0.00101 | 0.00106 | 0.00119 | 0.00113 | 0.00095 | 0.00105 | 8.86 |
| Ni | 0.00088 | 0.00096 | 0.00083 | 0.00097 | 0.00095 | 0.00091 | 0.00080 | 0.00087 | 0.00088 | 0.00089 | 6.17 |
| Cu | 0.00104 | 0.00116 | 0.00109 | 0.00102 | 0.00097 | 0.00103 | 0.00102 | 0.00097 | 0.00095 | 0.00103 | 6.01 |
| Cd | 0.00081 | 0.00083 | 0.00086 | 0.00094 | 0.00093 | 0.00090 | 0.00080 | 0.00082 | 0.00089 | 0.00086 | 5.75 |
| Cr | 0.00103 | 0.00106 | 0.00113 | 0.00126 | 0.00107 | 0.00101 | 0.00122 | 0.00106 | 0.00113 | 0.00111 | 7.27 |
| Tl | 0.00096 | 0.00093 | 0.00085 | 0.00080 | 0.00094 | 0.00096 | 0.00090 | 0.00082 | 0.00086 | 0.00089 | 6.42 |

试料3#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00229 | 0.00266 | 0.00234 | 0.00239 | 0.00273 | 0.00226 | 0.00239 | 0.00245 | 0.00269 | 0.00247 | 6.87 |
| Al | 0.00229 | 0.00239 | 0.00226 | 0.00253 | 0.00263 | 0.00261 | 0.00228 | 0.00237 | 0.00246 | 0.00242 | 5.49 |
| Pb | 0.00219 | 0.00268 | 0.00229 | 0.00226 | 0.00246 | 0.00258 | 0.00232 | 0.00256 | 0.00221 | 0.00239 | 7.07 |
| Ni | 0.00204 | 0.00219 | 0.00203 | 0.00200 | 0.00219 | 0.00221 | 0.00200 | 0.00196 | 0.00191 | 0.00206 | 5.05 |
| Cu | 0.00229 | 0.00256 | 0.00249 | 0.00276 | 0.00256 | 0.00266 | 0.00233 | 0.00246 | 0.00251 | 0.00251 | 5.53 |
| Cd | 0.00206 | 0.00196 | 0.00188 | 0.00196 | 0.00194 | 0.00216 | 0.00187 | 0.00195 | 0.00192 | 0.00197 | 4.36 |
| Cr | 0.00249 | 0.00269 | 0.00267 | 0.00248 | 0.00269 | 0.00276 | 0.00279 | 0.00281 | 0.00246 | 0.00265 | 4.90 |
| Tl | 0.00228 | 0.00245 | 0.00213 | 0.00206 | 0.00226 | 0.00218 | 0.00216 | 0.00209 | 0.00234 | 0.00222 | 5.38 |

试料4#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00529 | 0.00466 | 0.00534 | 0.00539 | 0.00473 | 0.00526 | 0.00539 | 0.00545 | 0.00569 | 0.00524 | 6.03 |
| Al | 0.00509 | 0.00476 | 0.00539 | 0.00534 | 0.00493 | 0.00539 | 0.00526 | 0.00545 | 0.00539 | 0.00522 | 4.37 |
| Pb | 0.00527 | 0.00469 | 0.00534 | 0.00534 | 0.00476 | 0.00526 | 0.00509 | 0.00533 | 0.00467 | 0.00508 | 5.44 |
| Ni | 0.00472 | 0.00489 | 0.00463 | 0.00459 | 0.00473 | 0.00472 | 0.00466 | 0.00454 | 0.00476 | 0.00469 | 2.07 |
| Cu | 0.00446 | 0.00487 | 0.00456 | 0.00422 | 0.00465 | 0.00443 | 0.00439 | 0.00455 | 0.00448 | 0.00451 | 3.78 |
| Cd | 0.00426 | 0.00423 | 0.00419 | 0.00446 | 0.00457 | 0.00453 | 0.00449 | 0.00432 | 0.00433 | 0.00438 | 3.01 |
| Cr | 0.00567 | 0.00584 | 0.00534 | 0.00536 | 0.00564 | 0.00559 | 0.00546 | 0.00582 | 0.00574 | 0.00561 | 3.13 |
| Tl | 0.00472 | 0.00489 | 0.00455 | 0.00512 | 0.00469 | 0.00487 | 0.00476 | 0.00499 | 0.00485 | 0.00483 | 3.31 |

试料5#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.00845 | 0.00779 | 0.00803 | 0.00799 | 0.00832 | 0.00816 | 0.00843 | 0.00794 | 0.00769 | 0.00809 | 3.16 |
| Al | 0.00756 | 0.00774 | 0.00723 | 0.00785 | 0.00756 | 0.00748 | 0.00756 | 0.00772 | 0.00731 | 0.00756 | 2.49 |
| Pb | 0.00774 | 0.00712 | 0.00726 | 0.00706 | 0.00735 | 0.00744 | 0.00769 | 0.00723 | 0.00716 | 0.00734 | 3.11 |
| Ni | 0.00712 | 0.00706 | 0.00689 | 0.00688 | 0.00674 | 0.00723 | 0.00694 | 0.00703 | 0.00700 | 0.00699 | 1.96 |
| Cu | 0.00746 | 0.00778 | 0.00732 | 0.00769 | 0.00754 | 0.00721 | 0.00773 | 0.00719 | 0.00734 | 0.00747 | 2.83 |
| Cd | 0.00669 | 0.00713 | 0.00703 | 0.00689 | 0.00703 | 0.00713 | 0.00722 | 0.00669 | 0.00703 | 0.00698 | 2.55 |
| Cr | 0.00814 | 0.00889 | 0.00867 | 0.00889 | 0.00823 | 0.00839 | 0.00816 | 0.00846 | 0.00855 | 0.00849 | 3.20 |
| Tl | 0.00789 | 0.00776 | 0.00779 | 0.00796 | 0.00769 | 0.00812 | 0.00773 | 0.00765 | 0.00759 | 0.00780 | 2.01 |

试料6#

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 测定次数元素 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 均值  (%) | RSD  (%) |
| Fe | 0.0106 | 0.0108 | 0.0109 | 0.0107 | 0.0102 | 0.0105 | 0.0112 | 0.0106 | 0.0103 | 0.0106 | 2.70 |
| Al | 0.00996 | 0.0102 | 0.00988 | 0.0102 | 0.0102 | 0.00965 | 0.00987 | 0.0.0104 | 0.00965 | 0.0100 | 2.49 |
| Pb | 0.00927 | 0.00968 | 0.00945 | 0.00907 | 0.00932 | 0.00915 | 0.00903 | 0.00879 | 0.00927 | 0.00923 | 2.62 |
| Ni | 0.00934 | 0.00954 | 0.00932 | 0.00927 | 0.00963 | 0.00935 | 0.00937 | 0.00929 | 0.00911 | 0.00936 | 1.52 |
| Cu | 0.00992 | 0.00963 | 0.00975 | 0.00943 | 0.00969 | 0.00954 | 0.00932 | 0.00938 | 0.00994 | 0.00962 | 2.20 |
| Cd | 0.00901 | 0.00921 | 0.00906 | 0.00969 | 0.00937 | 0.00952 | 0.00933 | 0.00943 | 0.00913 | 0.00931 | 2.27 |
| Cr | 0.0103 | 0.0108 | 0.0106 | 0.0102 | 0.0106 | 0.0104 | 0.0103 | 0.0101 | 0.0112 | 0.0105 | 3.08 |
| Tl | 0.00927 | 0.00934 | 0.00967 | 0.00919 | 0.00954 | 0.00932 | 0.00887 | 0.00903 | 0.00947 | 0.00930 | 2.52 |

**（9）**二验单位昆明冶金研究院比对样品分析结果：

试料1#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00080 0.00085 0.00090 0.00078 0.00091 0.00081  0.00079 0.00086 0.00092 0.00075 0.00084 | 0.00084 | 6.76 |
| Cd | 0.00045 0.00042 0.00047 0.00041 0.00049 0.00040  0.00042 0.00047 0.00046 0.00050 0.00040 | 0.00044 | 8.13 |
| Cu | 0.00058 0.00060 0.00061 0.00059 0.00065 0.000066  0.00062 0.00059 0.00057 0.00067 0.00068 | 0.00062 | 6.25 |
| Fe | 0.00065 0.00070 0.00071 0.00068 0.00075 0.00069  0.00075 0.00072 0.00064 0.00069 0.00073 | 0.00070 | 5.16 |
| Ni | 0.00050 0.00048 0.00045 0.00040 0.00052 0.00046  0.00053 0.00045 0.00043 0.00047 0.00054 | 0.00048 | 9.19 |
| Pb | 0.00053 0.00055 0.00060 0.00062 0.00052 0.00051  0.00058 0.00051 0.00050 0.00056 0.00058 | 0.00055 | 7.33 |
| Tl | 0.00039 0.00043 0.00045 0.00044 0.00038 0.00047  0.00043 0.00045 0.00040 0.00044 0.00046 | 0.00043 | 6.76 |
| Cr | 0.00066 0.00070 0.00068 0.00064 0.00074 0.00067  0.00071 0.00067 0.00069 0.00063 0.00072 | 0.00068 | 4.91 |

试料2#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00122 0.00102 0.00119 0.00110 0.00115 0.00106  0.00104 0.00125 0.00109 0.00117 0.00120 | 0.00114 | 6.84 |
| Cd | 0.00082 0.00085 0.00079 0.00088 0.00090 0.00084  0.00081 0.00086 0.00078 0.00084 0.00086 | 0.00084 | 4.38 |
| Cu | 0.00120 0.00125 0.00112 0.00115 0.00118 0.00110  0.00123 0.00113 0.00110 0.00109 0.00108 | 0.00115 | 5.12 |
| Fe | 0.00102 0.00105 0.00110 0.00108 0.00115 0.00112  0.00100 0.00099 0.00108 0.00104 0.00106 | 0.00106 | 4.67 |
| Ni | 0.00080 0.00077 0.00085 0.00084 0.00079 0.00082  0.00086 0.00088 0.00081 0.00076 0.00083 | 0.00082 | 4.58 |
| Pb | 0.00087 0.00096 0.00100 0.00103 0.00089 0.00095  0.00094 0.00086 0.00099 0.00094 0.00101 | 0.00095 | 6.01 |
| Tl | 0.00074 0.00085 0.00079 0.00080 0.00082 0.00086  0.00076 0.00078 0.00082 0.00079 0.00084 | 0.00080 | 4.66 |
| Cr | 0.00112 0.00121 0.00125 0.00129 0.00116 0.00118  0.00130 0.00123 0.00117 0.00111 0.00129 | 0.00121 | 5.61 |

试料3#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00276 0.00198 0.00240 0.00256 0.00261 0.00248  0.00265 0.00277 0.00221 0.00235 0.00261 | 0.00249 | 9.65 |
| Cd | 0.00185 0.00189 0.00193 0.00195 0.00200 0.00186  0.00184 0.00196 0.00188 0.00202 0.00196 | 0.00192 | 3.21 |
| Cu | 0.00262 0.00214 0.00251 0.00245 0.00220 0.00236  0.00257 0.00268 0.00249 0.00258 0.00239 | 0.00245 | 6.92 |
| Fe | 0.00262 0.00279 0.00265 0.00282 0.00260 0.00258  0.00274 0.00269 0.00276 0.00286 0.00290 | 0.00273 | 3.98 |
| Ni | 0.00197 0.00205 0.00195 0.00208 0.00194 0.00210  0.00203 0.00198 0.00206 0.00211 0.00199 | 0.00202 | 3.00 |
| Pb | 0.00220 0.00235 0.00245 0.00228 0.00236 0.00239  0.00229 0.00238 0.00239 0.00247 0.00227 | 0.00235 | 3.46 |
| Tl | 0.00214 0.00209 0.00218 0.00222 0.00211 0.00206  0.00229 0.00235 0.00210 0.00208 0.00206 | 0.00215 | 4.51 |
| Cr | 0.00296 0.00286 0.00261 0.00274 0.00279 0.00263  0.00263 0.00258 0.00294 0.00276 0.00273 | 0.00275 | 4.77 |

试料4#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00520 0.00528 0.00518 0.00512 0.00508 0.00506  0.00524 0.00507 0.00519 0.00538 0.00530 | 0.00519 | 2.00 |
| Cd | 0.00432 0.00422 0.00420 0.00438 0.00410 0.00409  0.00437 0.00431 0.00424 0.00417 0.00408 | 0.00423 | 2.59 |
| Cu | 0.00482 0.00496 0.00501 0.00471 0.00499 0.00506  0.00518 0.00469 0.00534 0.00465 0.00512 | 0.00496 | 4.43 |
| Fe | 0.00573 0.00493 0.00505 0.00551 0.00528 0.00534  0.00518 0.00526 0.00537 0.00567 0.00558 | 0.00535 | 4.70 |
| Ni | 0.00498 0.00485 0.00502 0.00472 0.00465 0.00459  0.00518 0.00485 0.00479 0.00463 0.00458 | 0.00480 | 4.06 |
| Pb | 0.00425 0.00451 0.00442 0.00478 0.00485 0.00460  0.00468 0.00475 0.00486 0.00449 0.00457 | 0.00461 | 4.14 |
| Tl | 0.00467 0.00475 0.00480 0.00445 0.00457 0.00491  0.00486 0.00432 0.00439 0.00457 0.00469 | 0.00463 | 4.17 |
| Cr | 0.00551 0.00557 0.00567 0.00576 0.00520 0.00524  0.00594 0.00595 0.00538 0.00547 0.00565 | 0.00558 | 4.50 |

试料5#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.00757 0.00751 0.00748 0.00724 0.00718 0.00727  0.00768 0.00754 0.00721 0.00718 0.00732 | 0.00738 | 2.43 |
| Cd | 0.00685 0.00691 0.00698 0.00674 0.00670 0.00712  0.00720 0.00664 0.00678 0.00710 0.00715 | 0.00692 | 2.86 |
| Cu | 0.00762 0.00768 0.00770 0.00725 0.00732 0.00738  0.00785 0.00796 0.00748 0.00755 0.00760 | 0.00758 | 2.86 |
| Fe | 0.00838 0.00832 0.00824 0.00811 0.00818 0.00805  0.00845 0.00851 0.00794 0.00805 0.00787 | 0.00819 | 2.55 |
| Ni | 0.00678 0.00685 0.00702 0.00732 0.00748 0.00738  0.00684 0.00704 0.00695 0.00724 0.00739 | 0.00712 | 3.54 |
| Pb | 0.00699 0.00708 0.00728 0.00735 0.00712 0.00724  0.00701 0.00685 0.00697 0.00741 0.00728 | 0.00714 | 2.51 |
| Tl | 0.00774 0.00785 0.00805 0.00814 0.00768 0.00796  0.00812 0.00784 0.00771 0.00745 0.00828 | 0.00789 | 3.09 |
| Cr | 0.00833 0.00873 0.00865 0.00825 0.00860 0.00794  0.00818 0.00884 0.00860 0.00847 0.00857 | 0.00847 | 3.15 |

试料6#的精密度

|  |  |  |  |
| --- | --- | --- | --- |
| 元素 | 测定值（%） | 平均值（%） | RSD% |
| Al | 0.0104 0.0115 0.00985 0.00976 0.0121 0.0118  0.00978 0.0108 0.0120 0.0107 0.00969 | 0.0106 | 8.05 |
| Cd | 0.00863 0.00880 0.00895 0.00920 0.00928 0.00945  0.00951 0.00887 0.00899 0.00946 0.00938 | 0.00914 | 3.33 |
| Cu | 0.00911 0.00988 0.00976 0.00958 0.00969 0.0102  0.0108 0.00976 0.00989 0.0108 0.00969 | 0.00992 | 5.10 |
| Fe | 0.0103 0.0110 0.0105 0.00995 0.00987 0.00974  0.0112 0.0115 0.0124 0.0107 0.0106 | 0.0107 | 7.39 |
| Ni | 0.00873 0.00884 0.00924 0.00896 0.00950 0.00947  0.00921 0.00935 0.00941 0.00895 0.00957 | 0.00920 | 3.15 |
| Pb | 0.00875 0.00895 0.00912 0.00857 0.0876 0.00925  0.00899 0.00865 0.00922 0.00887 0.00890 | 0.00891 | 2.50 |
| Tl | 0.00920 0.00935 0.00901 0.00915 0.00938 0.00917  0.00941 0.00914 0.00924 0.00903 0.00927 | 0.00921 | 1.44 |
| Cr | 0.0109 0.0101 0.0107 0.00998 0.0110 0.00995  0.0105 0.0112 0.0109 0.0114 0.0103 | 0.0106 | 4.70 |

**（10）**二验单位国标（北京）检验认证有限公司比对样品分析结果：

**1#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.00055 | 0.00062 | 0.00072 | 0.00056 | 0.00057 | 0.00063 | 0.000575 | 11.99 |
| 0.00049 | 0.00052 | 0.00051 | 0.00063 | 0.00052 |  |
| Al | 0.00062 | 0.00073 | 0.00058 | 0.00066 | 0.00082 | 0.00055 | 0.000669 | 12.42 |
| 0.00059 | 0.00066 | 0.00075 | 0.00074 | 0.00066 |  |
| Pb | 0.00048 | 0.00051 | 0.00042 | 0.00039 | 0.00054 | 0.00060 | 0.000492 | 13.63 |
| 0.00045 | 0.00046 | 0.00055 | 0.00057 | 0.00044 |  |
| Ni | 0.00037 | 0.00049 | 0.00042 | 0.00038 | 0.00041 | 0.00048 | 0.000425 | 12.96 |
| 0.00036 | 0.00047 | 0.00044 | 0.00050 | 0.00035 |  |
| Cu | 0.00056 | 0.00062 | 0.00058 | 0.00047 | 0.00063 | 0.00066 | 0.000583 | 8.41 |
| 0.00058 | 0.00059 | 0.00055 | 0.00058 | 0.00059 |  |
| Cd | 0.00053 | 0.00055 | 0.00046 | 0.00051 | 0.00048 | 0.00047 | 0.000493 | 6.92 |
| 0.00045 | 0.00052 | 0.00047 | 0.00046 | 0.00052 |  |
| Cr | 0.00070 | 0.00084 | 0.00068 | 0.00069 | 0.00072 | 0.00075 | 0.000726 | 7.79 |
| 0.00081 | 0.00072 | 0.00069 | 0.00065 | 0.00074 |  |
| Tl | 0.00044 | 0.00045 | 0.00052 | 0.00038 | 0.00056 | 0.00049 | 0.000479 | 12.29 |
| 0.00046 | 0.00052 | 0.00057 | 0.00046 | 0.00042 |  |

**2#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.00121 | 0.00108 | 0.00113 | 0.00107 | 0.00122 | 0.00118 | 0.00114 | 5.44 |
| 0.00106 | 0.00114 | 0.00115 | 0.00123 | 0.00109 |  |
| Al | 0.00114 | 0.00125 | 0.00108 | 0.00123 | 0.00125 | 0.00116 | 0.00119 | 7.16 |
| 0.00103 | 0.00122 | 0.00119 | 0.00131 | 0.00128 |  |
| Pb | 0.00108 | 0.00099 | 0.00109 | 0.00112 | 0.00104 | 0.00105 | 0.00113 | 7.80 |
| 0.00116 | 0.00123 | 0.00127 | 0.00122 | 0.00115 |  |
| Ni | 0.00103 | 0.00096 | 0.00105 | 0.00099 | 0.00089 | 0.00102 | 0.00096 | 6.81 |
| 0.00088 | 0.00091 | 0.00102 | 0.00096 | 0.00087 |  |
| Cu | 0.00102 | 0.00093 | 0.00112 | 0.00121 | 0.00105 | 0.00118 | 0.00110 | 7.44 |
| 0.00106 | 0.00117 | 0.00116 | 0.00109 | 0.00111 |  |
| Cd | 0.00086 | 0.00098 | 0.00102 | 0.00095 | 0.00091 | 0.00097 | 0.00095 | 7.29 |
| 0.00093 | 0.00089 | 0.00086 | 0.00109 | 0.00094 |  |
| Cr | 0.00112 | 0.00107 | 0.00099 | 0.00105 | 0.00111 | 0.00108 | 0.00107 | 3.76 |
| 0.00106 | 0.00103 | 0.00112 | 0.00108 | 0.00104 |  |
| Tl | 0.00103 | 0.00104 | 0.00093 | 0.00096 | 0.00094 | 0.00102 | 0.00098 | 5.63 |
| 0.00101 | 0.00096 | 0.00105 | 0.00099 | 0.00087 |  |

**3#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.00268 | 0.00255 | 0.00264 | 0.00285 | 0.00271 | 0.00263 | 0.00269 | 3.47 |
| 0.00259 | 0.00272 | 0.00281 | 0.00277 | 0.00263 |  |
| Al | 0.00254 | 0.00263 | 0.00251 | 0.00248 | 0.00244 | 0.00263 | 0.00253 | 3.30 |
| 0.00237 | 0.00255 | 0.00258 | 0.00247 | 0.00261 |  |
| Pb | 0.00255 | 0.00239 | 0.00242 | 0.00224 | 0.00222 | 0.00238 | 0.00236 | 4.05 |
| 0.00241 | 0.00229 | 0.00235 | 0.00241 | 0.00228 |  |
| Ni | 0.00229 | 0.00239 | 0.00241 | 0.00234 | 0.00249 | 0.00242 | 0.00239 | 2.63 |
| 0.00238 | 0.00229 | 0.00246 | 0.00241 | 0.00237 |  |
| Cu | 0.00233 | 0.00245 | 0.00238 | 0.00241 | 0.00239 | 0.00236 | 0.00243 | 3.16 |
| 0.00252 | 0.00244 | 0.00236 | 0.00249 | 0.00258 |  |
| Cd | 0.00204 | 0.00219 | 0.00225 | 0.00225 | 0.00218 | 0.00238 | 0.00221 | 4.77 |
| 0.00214 | 0.00218 | 0.00206 | 0.00227 | 0.00234 |  |
| Cr | 0.00233 | 0.00265 | 0.00249 | 0.00258 | 0.00263 | 0.00257 | 0.00256 | 3.77 |
| 0.00255 | 0.00263 | 0.00268 | 0.00251 | 0.00256 |  |
| Tl | 0.00237 | 0.00242 | 0.00246 | 0.00251 | 0.00238 | 0.00244 | 0.00247 | 3.33 |
| 0.00237 | 0.00248 | 0.00256 | 0.00255 | 0.00261 |  |

**4#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.00596 | 0.00581 | 0.00545 | 0.00577 | 0.00556 | 0.00543 | 0.00564 | 3.20 |
| 0.00582 | 0.00541 | 0.00562 | 0.00566 | 0.00557 |  |
| Al | 0.00489 | 0.00502 | 0.00511 | 0.00497 | 0.00488 | 0.00505 | 0.00498 | 1.84 |
| 0.00486 | 0.00492 | 0.00507 | 0.00510 | 0.00494 |  |
| Pb | 0.00507 | 0.00511 | 0.00487 | 0.00475 | 0.00515 | 0.00506 | 0.00496 | 3.26 |
| 0.00501 | 0.00489 | 0.00469 | 0.00482 | 0.00513 |  |
| Ni | 0.00471 | 0.00475 | 0.00481 | 0.00452 | 0.00507 | 0.00511 | 0.00488 | 4.01 |
| 0.00487 | 0.00476 | 0.00512 | 0.00508 | 0.00493 |  |
| Cu | 0.00446 | 0.00459 | 0.00481 | 0.00514 | 0.00521 | 0.00508 | 0.00486 | 5.10 |
| 0.00468 | 0.00472 | 0.00503 | 0.00505 | 0.00474 |  |
| Cd | 0.00454 | 0.00445 | 0.00450 | 0.00473 | 0.00462 | 0.00448 | 0.00458 | 2.00 |
| 0.00452 | 0.00471 | 0.00462 | 0.00463 | 0.00458 |  |
| Cr | 0.00595 | 0.00572 | 0.00581 | 0.00607 | 0.00602 | 0.00598 | 0.00595 | 2.04 |
| 0.00606 | 0.00588 | 0.00611 | 0.00584 | 0.00597 |  |
| Tl | 0.00477 | 0.00485 | 0.00502 | 0.00501 | 0.00469 | 0.00482 | 0.00487 | 3.19 |
| 0.00463 | 0.00471 | 0.00505 | 0.00506 | 0.00492 |  |

**5#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.00793 | 0.00810 | 0.00805 | 0.00799 | 0.00804 | 0.00785 | 0.00800 | 1.48 |
| 0.00802 | 0.00807 | 0.00789 | 0.00786 | 0.00825 |  |
| Al | 0.00814 | 0.00739 | 0.00811 | 0.00756 | 0.00749 | 0.00792 | 0.00769 | 6.38 |
| 0.00805 | 0.00709 | 0.00853 | 0.00742 | 0.00694 |  |
| Pb | 0.00767 | 0.00748 | 0.00788 | 0.00759 | 0.00771 | 0.00762 | 0.00764 | 1.85 |
| 0.00753 | 0.00778 | 0.00780 | 0.00759 | 0.00742 |  |
| Ni | 0.00705 | 0.00788 | 0.00712 | 0.00764 | 0.00758 | 0.00745 | 0.00753 | 3.63 |
| 0.00762 | 0.00764 | 0.00731 | 0.00785 | 0.00772 |  |
| Cu | 0.00782 | 0.00785 | 0.00756 | 0.00779 | 0.00793 | 0.00784 | 0.00787 | 2.17 |
| 0.00762 | 0.00791 | 0.00805 | 0.00810 | 0.00805 |  |
| Cd | 0.00699 | 0.00694 | 0.00698 | 0.00689 | 0.00675 | 0.00692 | 0.00696 | 1.75 |
| 0.00703 | 0.00705 | 0.00680 | 0.00712 | 0.00714 |  |
| Cr | 0.00808 | 0.00824 | 0.00845 | 0.00802 | 0.00865 | 0.00851 | 0.00834 | 4.18 |
| 0.00853 | 0.00836 | 0.00904 | 0.00785 | 0.00798 |  |
| Tl | 0.00743 | 0.00782 | 0.00779 | 0.00756 | 0.00762 | 0.00781 | 0.00766 | 3.29 |
| 0.00777 | 0.00759 | 0.00789 | 0.00791 | 0.00705 |  |

**6#样品精密度数据**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 元素 | 测定值/% | | | | | | 平均值/% | RSD/% |
| Fe | 0.0112 | 0.0104 | 0.0105 | 0.0113 | 0.0113 | 0.0104 | 0.01075 | 3.98 |
| 0.0101 | 0.0105 | 0.0112 | 0.0107 | 0.0106 |  |
| Al | 0.0106 | 0.0109 | 0.0112 | 0.0113 | 0.0107 | 0.0112 | 0.01098 | 4.46 |
| 0.0114 | 0.0108 | 0.0109 | 0.00994 | 0.0118 |  |
| Pb | 0.00865 | 0.00902 | 0.00874 | 0.00888 | 0.00961 | 0.00959 | 0.00898 | 4.44 |
| 0.00876 | 0.00923 | 0.00892 | 0.00914 | 0.00827 |  |
| Ni | 0.00969 | 0.00981 | 0.00967 | 0.00976 | 0.01030 | 0.00952 | 0.00986 | 3.21 |
| 0.00974 | 0.00965 | 0.00981 | 0.01060 | 0.00993 |  |
| Cu | 0.00994 | 0.00972 | 0.0102 | 0.0107 | 0.00985 | 0.00993 | 0.0101 | 4.25 |
| 0.0100 | 0.00976 | 0.0111 | 0.00993 | 0.00986 |  |
| Cd | 0.00925 | 0.00918 | 0.00924 | 0.00980 | 0.00956 | 0.00947 | 0.00941 | 2.20 |
| 0.00929 | 0.00942 | 0.00953 | 0.00914 | 0.00961 |  |
| Cr | 0.0114 | 0.0113 | 0.0108 | 0.0112 | 0.0109 | 0.0105 | 0.0111 | 3.97 |
| 0.0110 | 0.0106 | 0.0119 | 0.0107 | 0.0116 |  |
| Tl | 0.00958 | 0.00947 | 0.00935 | 0.00966 | 0.00954 | 0.00937 | 0.00949 | 1.04 |
| 0.00946 | 0.00944 | 0.00939 | 0.00957 | 0.00955 |  |

**5）**精密度

经广西壮族自治区分析测试研究中心、广西壮族自治区冶金产品质量监督检验站、广西晶联光电材料有限责任公司、北矿检测技术有限公司、广西壮族自治区地质矿产测试研究中心、广东先导稀材股份有限公司、南宁奥博斯检测科技有限责任公司、国标（北京）检验认证有限公司、洛阳晶联光电材料有限责任公司、昆明冶金研究院十家实验室分析结果统计，方法精密度如下：重复性限见表1、再现性限见表2。

表1 **重复性限**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *W*Fe /％ | 0.00059 | 0.0010 | 0.0026 | 0.0054 | 0.0081 | 0.011 |
| /％ | 0.00019 | 0.00020 | 0.00051 | 0.00075 | 0.00081 | 0.0012 |
| *W*Al /％ | 0.00069 | 0.0012 | 0.0025 | 0.0053 | 0.0076 | 0.010 |
| /％ | 0.00020 | 0.00025 | 0.00048 | 0.00059 | 0.00083 | 0.0013 |
| *W*Pb/％ | 0.00047 | 0.0010 | 0.0024 | 0.0049 | 0.0073 | 0.0091 |
| /％ | 0.00015 | 0.00023 | 0.00043 | 0.00066 | 0.00069 | 0.00088 |
| *W*Ni /％ | 0.00042 | 0.00086 | 0.0022 | 0.0047 | 0.0074 | 0.0095 |
| /％ | 0.00012 | 0.00019 | 0.00033 | 0.00049 | 0.00071 | 0.00083 |
| *W*Cu /％ | 0.00059 | 0.0011 | 0.0025 | 0.0049 | 0.0076 | 0.0099 |
| /％ | 0.00021 | 0.00021 | 0.00041 | 0.00058 | 0.00070 | 0.0010 |
| *W*Cd /％ | 0.00047 | 0.00089 | 0.0020 | 0.0044 | 0.0071 | 0.0094 |
| /％ | 0.00012 | 0.00017 | 0.00026 | 0.00037 | 0.00052 | 0.00065 |
| *W*Cr /％ | 0.00068 | 0.0012 | 0.0026 | 0.0058 | 0.0085 | 0.011 |
| /％ | 0.00013 | 0.00020 | 0.00034 | 0.00063 | 0.00074 | 0.0010 |
| *W*Tl /％ | 0.00046 | 0.00089 | 0.0023 | 0.0048 | 0.0079 | 0.0095 |
| /％ | 0.00013 | 0.00017 | 0.00032 | 0.00052 | 0.00063 | 0.00064 |

表 2 再现性限

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| *W*Fe /％ | 0.00059 | 0.0010 | 0.0026 | 0.0054 | 0.0081 | 0.011 |
| R/％ | 0.00024 | 0.00027 | 0.00054 | 0.00079 | 0.00081 | 0.0013 |
| *W*Al /％ | 0.00069 | 0.0012 | 0.0025 | 0.0053 | 0.0076 | 0.010 |
| R/％ | 0.00025 | 0.00026 | 0.00048 | 0.00082 | 0.00089 | 0.0015 |
| *W*Pb/％ | 0.00047 | 0.0010 | 0.0024 | 0.0049 | 0.0073 | 0.0091 |
| R/％ | 0.00018 | 0.00027 | 0.00047 | 0.00075 | 0.00076 | 0.00088 |
| *W*Ni /％ | 0.00042 | 0.00086 | 0.0022 | 0.0047 | 0.0074 | 0.0095 |
| R/％ | 0.00015 | 0.00023 | 0.00053 | 0.00055 | 0.00092 | 0.0010 |
| *W*Cu /％ | 0.00059 | 0.0011 | 0.0025 | 0.0049 | 0.0076 | 0.0099 |
| R/％ | 0.00021 | 0.00023 | 0.00041 | 0.00073 | 0.00074 | 0.0010 |
| *W*Cd /％ | 0.00047 | 0.00089 | 0.0020 | 0.0044 | 0.0071 | 0.0094 |
| R/％ | 0.00014 | 0.00020 | 0.00039 | 0.00049 | 0.00058 | 0.00074 |
| *W*Cr /％ | 0.00068 | 0.0012 | 0.0026 | 0.0058 | 0.0085 | 0.011 |
| R/％ | 0.00015 | 0.00022 | 0.00046 | 0.00074 | 0.00080 | 0.0012 |
| *W*Tl /％ | 0.00046 | 0.00089 | 0.0023 | 0.0048 | 0.0079 | 0.0095 |
| R/％ | 0.00014 | 0.00022 | 0.00045 | 0.00055 | 0.00065 | 0.00080 |

**四、国内外同类标准的对比分析**

目前，国内外尚未见以电感耦合等离子体发射光谱法测定掺锡氧化铟粉中铁、铝、铅、镍、铜、镉、铬、铊含量测定的分析标准。

**五**、**与现行法规、标准的关系**

本标准的制订与现行标准没有冲突，且符合国家相关法律法规的规定。

**六**、**重大分歧意见的处理经过和依据**

标准制订过程中，无重大分歧意见。

**七、标准水平**

本标准在制定过程中，以生产实际为依据，广泛征集国内生产厂家和用户意见，采用了目前国际上广泛使用的电感等离子体发射光谱法，标准客观反映了目前掺锡氧化铟粉杂质元素检测技术现状，具有适用性、准确性、指导性，填补掺锡氧化铟粉杂质元素检测的标准空白。

本标准达到国际先进水平。

**八、下一步工作**

根据对生产企业、用户及检验单位的征求意见和建议，进一步修改、完善标准草案，尽快形成标准报批稿。

**九、附录**

标准送审稿意见汇总处理表。

附录：

标准送审稿意见汇总处理表

起草单位：广西壮族自治区分析测试研究中心

意见汇总处理人：林葵

电话：17776252774

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 序号 | 标准章条编号 | 意见内容 | 提出单位 | 处理  意见 | 备注 |
| 1 | 封面（以下同） | “量的测定”改为“含量的测定”。 | 中国有色金属工业标准计量质量研究所 | 采纳 |  |
| 2 | 2 | 增加规范性引用文件：水，GB/T 6682。其他章节号顺延。 | 贵州省分析测试研究院 | 采纳 |  |
| 3 | 4 | 增加4.1 水，GB/T 6682, 一级。其他章节号顺延。 | 贵州省分析测试研究院 | 采纳 |  |
| 4 | 4.4 | “稍冷后加入50 mL盐酸” 改为“稍冷后加入70 mL盐酸”。 | 云南锡业股份有限公司 | 采纳 |  |
| 5 | 5.2 | 铝的推荐谱线改为396.152，铊的推荐谱线改为190.794，增加“注:可根据仪器具体情况选择适宜谱线” | 四川省冶金产品质量监督检验站 | 采纳 |  |
| 6 | 7 | “分析步骤”改为“试验步骤”。 | 阳谷祥光铜业有限公司 | 采纳 |  |
| 7 | 7.2 | “测定次数”改成“平行试验”。  “独立地进行两次测定”改成“平行做两份试验”。 | 金川集团股份有限公司 | 采纳 |  |
| 8 | 7.4 | “分析试液”改成“测定”。 | 广西南南铝加工有限公司 | 采纳 |  |
| 9 | 7.4.1 | “加入2.0 g氢氧化钠”改为“加入1.0 g氢氧化钠” | 大冶有色设计研究院有限公司 | 不采纳 | 1.0g氢氧化钠量少，难以铺垫覆盖。 |
| 10 | 8 | “分析结果计算”改为“试验数据处理” | 云南驰宏锌锗股份有限公司 | 采纳 |  |
| 11 |  | 回函同意，无意见。 | 广东邦普循环科技有限公司 |  |  |
| 12 |  | 回函同意，无意见。 | 格林美股份公司 |  |  |
| 13 |  | 回函同意，无意见。 | 湖南有色金属研究院 |  |  |
| 14 |  | 回函同意，无意见。 | 广西大学 |  |  |
| 15 |  | 回函同意，无意见。 | 广西冶金研究院 |  |  |
| 16 |  | 回函同意，无意见。 | 河南豫光金铅股份有限公司 |  |  |

说明：（1）发送《送审稿》的单位数：15个；

（2）提出修改意见的单位数：9个；

（3）回函同意，无意见的单位数：6个。