Ag/SnO₂

Silver Tin Oxide
Powder Metallurgical
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**SCOPE:** This information refers to silver tin oxide wires, profiles and contact tips manufactured by blending of silver and metal oxide powder without (SP) or with additives (SPW/PMT), compacting, sintering, extruding and drawing or rolling to final dimension. Profiles and tips are available with a backing layer of silver and optionally with an additional layer of a brazing alloy.

**Designation of standard compositions**
The silver content is designated by the first number: e.g. Ag/SnO₂ 88/12 with 88 wt.-% silver, balance metal oxides. The typical gradation of the latter are 8, 10, 12 and 14. Additives improve the switching behaviour of the different materials.

**Applications**
- contactors
- automotive relays
- power line relays
- earth leakage breakers, miniature circuit breakers
- switches for domestic applications, main switches
- circuit breakers up to switching currents of 5000 A

**Characteristics**
- best anti-welding properties on make of all silver metal oxide variants up to currents of 5000 A (increasing with higher oxide content)
- lowest erosion rate of all silver metal oxide materials for currents exceeding 100 A
- significantly less material migration compared to Ag/CdO and Ag/ZnO
- low contact resistance comparable to other silver metal oxides
- special additives keep the contact resistance stable throughout the service life
- excellent arc extinguishing properties
- RoHS + ELV conform

**Physical Properties**
The physical properties depend mainly on the composition. The effect of the SnO₂ content is shown in the following for one type of material.

<table>
<thead>
<tr>
<th>Ag/SnO₂</th>
<th>DENSITY [g/cm³]</th>
<th>ELECTRICAL CONDUCTIVITY [m/(Ω·mm²)]</th>
<th>HARDNESS SOFT [HV1]</th>
<th>TENSILE STRENGTH SOFT [MPa]</th>
<th>ELONGATION [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>92/8 SPW</td>
<td>10.1</td>
<td>48</td>
<td>57</td>
<td>200–260</td>
<td>&gt; 28</td>
</tr>
<tr>
<td>90/10 SPW</td>
<td>10.0</td>
<td>47</td>
<td>62</td>
<td>210–270</td>
<td>&gt; 26</td>
</tr>
<tr>
<td>88/12 SPW</td>
<td>9.9</td>
<td>45</td>
<td>67</td>
<td>220–280</td>
<td>&gt; 24</td>
</tr>
</tbody>
</table>

**Microstructure**
The micron sized SnO₂ particles are oriented slightly along the direction of extrusion.

**Ag/SnO₂ 92/8 SPW**
- longitudinal section

**Ag/SnO₂ 88/12 SPW**
- longitudinal section

**Ag/SnO₂ 88/12 SPW**
- cross section
### Key features of standard compositions

<table>
<thead>
<tr>
<th>Designation</th>
<th>Composition</th>
<th>Content of Oxides [wt-%]</th>
<th>Additive</th>
<th>Application</th>
<th>Wires</th>
<th>Profiles Contact Tips</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>SP</td>
<td>Wire Quality</td>
<td>8, 10, 12</td>
<td>none</td>
<td>medium for low loads in the current range &lt; 25 A</td>
<td>X</td>
<td></td>
<td>good workability, especially for demanding riveting</td>
</tr>
<tr>
<td>SPW</td>
<td>Standard Wire Quality</td>
<td>2, 8, 10, 12</td>
<td>WO_3</td>
<td>medium for high loads in the current range &gt; 25 A</td>
<td>X</td>
<td></td>
<td>lower contact resistance, improved welding resistance</td>
</tr>
<tr>
<td>SPW4</td>
<td>Standard Profil Quality</td>
<td>8, 10, 12</td>
<td>WO_3</td>
<td>medium automotive relays; contactor esp. for devices with large tips or more complex tip design, AC and DC application</td>
<td>X</td>
<td></td>
<td>best workability of all profil qualities</td>
</tr>
<tr>
<td>SPW6</td>
<td>Universal Contactor Quality</td>
<td>12</td>
<td>MoO_3</td>
<td>fine AC contactors for the current range for Contactor from 20 A up to 400 A</td>
<td>X</td>
<td></td>
<td>material especially for contactors</td>
</tr>
<tr>
<td>SPW7</td>
<td>Superior Profil Quality</td>
<td>12</td>
<td>WO_3, Bi_2O_3</td>
<td>medium contactors with high make capacities and long life time with AC3 load, automotive relays for high lamp loads</td>
<td>X</td>
<td></td>
<td>best resistance against welding of all silvermetal-oxide materials</td>
</tr>
<tr>
<td>PMT1</td>
<td>Special Wire Quality</td>
<td>8, 10, 12</td>
<td>Bi_2O_3</td>
<td>coarse automotive relays (lamp, resistance and motor loads)</td>
<td>X</td>
<td></td>
<td>high resistance against welding on make, low erosion rate with inductive loads</td>
</tr>
<tr>
<td>PMT3</td>
<td>Superior Profil Quality</td>
<td>14</td>
<td>Bi_2O_3</td>
<td>medium AC contactors for current range &gt; 50 A</td>
<td>X</td>
<td></td>
<td>lowest erosion rate with inductive loads, high resistance against welding</td>
</tr>
</tbody>
</table>
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