**AgSnO₂**

**Silver Tin-Oxide**

**Powder Metallurgical**

**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

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

**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>
### Key features of standard compositions

<table>
<thead>
<tr>
<th>Ag/SnO₂</th>
<th>DESIGNATION</th>
<th>CONTENT OF OXIDES [WT-%]</th>
<th>ADDITIVE</th>
<th>SnO₂ PARTICLES SIZE</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 8, 10, 12, 14</td>
<td>none</td>
<td>medium</td>
<td>for low loads in the current range &lt; 25 A</td>
<td>X</td>
<td></td>
<td></td>
<td>good workability, especially for demanding riveting</td>
</tr>
<tr>
<td>SPW</td>
<td>Standard Wire Quality 2, 8, 10, 12</td>
<td>WO₃</td>
<td>medium</td>
<td>for high loads in the current range &lt; 25 A</td>
<td>X</td>
<td></td>
<td></td>
<td>lower contact resistance, improved welding resistance</td>
</tr>
<tr>
<td>SPW4</td>
<td>Standard Profil Quality 8, 10, 12</td>
<td>WO₃</td>
<td>medium</td>
<td>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></td>
<td>best workability of all profil qualities</td>
</tr>
<tr>
<td>SPW6</td>
<td>Universal Contactor Quality 12</td>
<td>MoO₃</td>
<td>fine</td>
<td>AC contactors for the current range for Contactor from 20 A up to 400 A</td>
<td>X</td>
<td></td>
<td></td>
<td>material especially for contactors</td>
</tr>
<tr>
<td>SPW7</td>
<td>Superior Profil Quality 12</td>
<td>WO₃, Bi₂O₃</td>
<td>medium</td>
<td>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></td>
<td>best resistance against welding of all silvermetall-oxide materials</td>
</tr>
<tr>
<td>PMT1</td>
<td>Special Wire Quality 8, 10, 12</td>
<td>Bi₂O₃</td>
<td>coarse</td>
<td>automotive relays (lamp, resistance and motor loads)</td>
<td>X</td>
<td></td>
<td></td>
<td>highest resistance against welding, low erosion rate with inductive loads</td>
</tr>
<tr>
<td>PMT3</td>
<td>Superior Profil Quality 14</td>
<td>Bi₂O₃</td>
<td>medium</td>
<td>AC contactors for current range &gt; 50 A</td>
<td>X</td>
<td></td>
<td></td>
<td>lowest erosion rate with inductive loads, high resistance against welding</td>
</tr>
</tbody>
</table>

### Impact of Metal Oxide on Content on switching properties

<table>
<thead>
<tr>
<th>Metal Oxide Content (wt %)</th>
<th>Contact resistance</th>
<th>Weld break force</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Erosion Rates against Metal Oxide content

<table>
<thead>
<tr>
<th>Metal Oxide Content (wt %)</th>
<th>Total Erosion</th>
<th>Specific Erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

USA

**Attleboro**
Umicore Electrical Materials USA, Inc.
527 Pleasant Street, Building 11
Attleboro, MA 02703
Phone: +1 508 838 2064
Fax: +1 508 838 2062
Jay.Burnett@am.Umicore.com

**Glens Falls**
Umicore Technical Materials North America Inc.
9 Pruyn’s Island Drive
Glens Falls, NY 12801
Phone: +1 732 485 2256
Fax: +1 518-792-3162
Kay.Solecki@am.umicore.com

www.UmicoreElectricalMaterialsUSA.com

The information and statements contained herein are provided free of charge and are for general information purposes only. They are believed to be accurate at the time of publication, but Umicore makes no representations or warranty of any kind with respect thereto, express or implied, about the completeness, accuracy, reliability, suitability or availability. Use or application of such information or statements is at the user’s discretion, without any liability on the part of Umicore. Nothing herein shall be constructed as a license or recommendation to use. Umicore reserves the right to alter any product or service at its own discretion. All sales are subject to Umicore's General Terms and Conditions of Sale and Delivery.