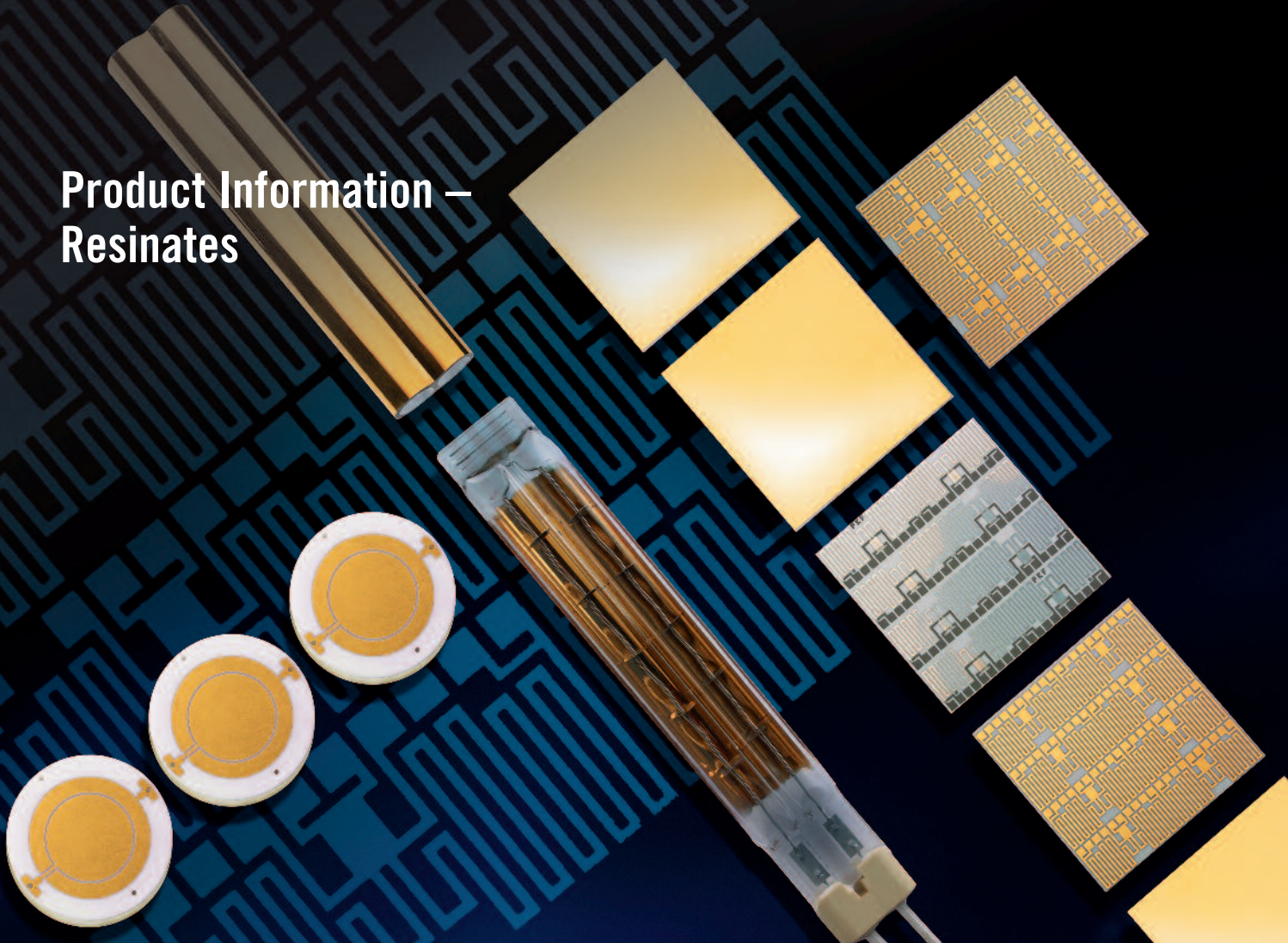


Product Information – Resinates



As a part of its business, the Thick Film Materials Division of Heraeus Precious Metals produces resinates. These are solutions of metal compounds in organic oils. In comparison to traditional thick film inks consisting of discrete particles in suspension, all of the constituents in resinates are in true solution. Especially this specific characteristic can provide significant advantages compared to thick film products. Screen blocking by large particles or agglomerates is unlikely and therefore very fine screen meshes can be used. The metallic and glass forming oxides in true solution are uniformly dispersed resulting in alloy formation during firing.

The most important difference between the traditional thick film products and metallo-organics is the thickness of the fired films. Fired film thicknesses typically range from 5 – 15 μm while the fired thickness of a metallo-organic compound ranges from 0.1 – 1 μm . The extremely thin films of metal might be conductive or resistive, depending on the individual formulation and can be etched in order to provide extremely fine line definition. Because of the thin nature of these films, it is necessary to choose appropriate smooth substrates. Potential substrate among others are Al_2O_3 , glazed Al_2O_3 , glass, quartz glass, metal alloys and steel enamel.

Application

Resinates are mainly applied by screen printing. Other application methods like brushing, spraying, stamping, dipping or roll coating are possible as well, providing the preparation is adjusted to the respective application.

Each of the mentioned application techniques requires certain knowledge of the user in order to obtain satisfactory results. Screen printing is the most common method of applying a film, it is very important to monitor a number of variables. Usage of polyester screen is generally possible but stainless steel screens with a fairly fine mesh (280 – 400 mesh) are recommended. The wet prints should not exceed 20 – 35 µm in order to prevent the formation of blisters and cracking during the firing process.

Levelling and drying

After application has been completed, the print has to rest 5 – 10 minutes at ambient temperature in order that any unevenness can level off. The applied film should be dried in drying ovens or belt dryers at 80 – 125°C for approximately 10 – 20 minutes. Higher temperatures are not recommended due to the risk of paste tearing.

If large volumes of material are dried, it is necessary to vent the volatiles. After drying, the films should have reasonable dry strength, providing they are not scratched by rough surfaces. Dried layers can be tacky in warm conditions. Prior to firing, the applied films should be inspected for uniform application.

Firing

The firing of the applied resinate film should be carried out in muffle furnaces or multizone furnaces for combustion. During firing the decomposition of remaining organic takes place, the formation and sintering of the metallic layer and its bonding to the substrate occur.

Firing has to be in an oxidative atmosphere for the complete burnout of the organic compounds. The maximum peak temperature and the soaking time depend on the substrate and the preparation used.

The metallic layer follows the roughness of the surface from the substrate. Cooling may then occur at any rate deemed desirable, limited only by the thermal shock characteristics of the substrate.

Typical properties of resinates

- Metallo-organics contain metals in dissolved form in comparison to thick film materials which contain metal powders
- Metal content below 25 %
- Fired layer thicknesses are 0.1 – 1 µm (comparable to sputtering), thick film > 2.0 µm
- Achieved layers do not contain amorphous structures and can be etched like sputtered layers with good fine line definition
- Application costs are significantly lower than sputtering, comparable to thick film
- Shrinkage: Wet 15 – 25 µm, dry 5 – 15 µm, fired < 1 µm

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