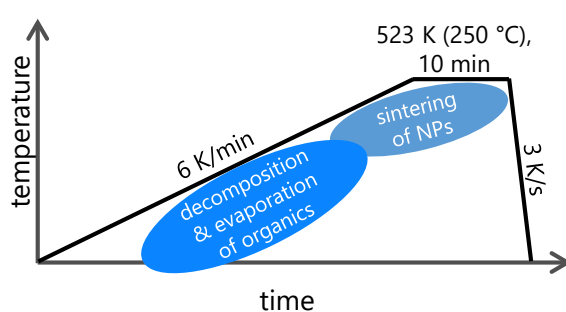


Sintering with Nanopastes

Empa Department 202, Joining Technologies and Corrosion

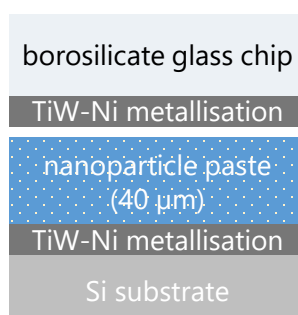
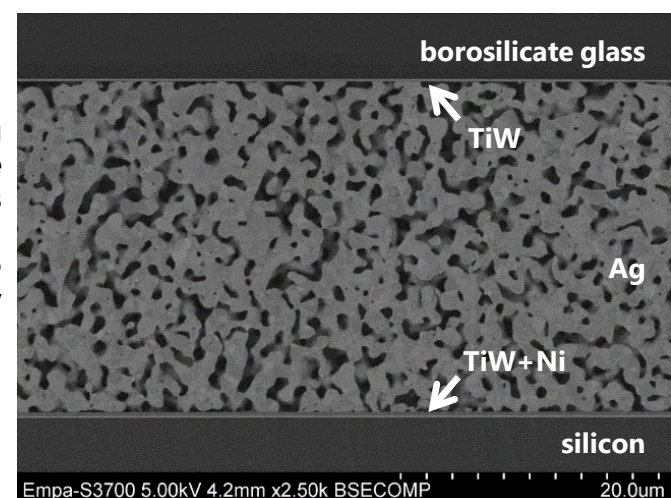
Principle

Nanopastes consist of (usually metallic) nanoparticles and organic additives (surfactants, binder, solvents). Joining with nanopastes is based on the high sintering activity of nanoscaled metal particles (esp. via surface diffusion). Upon heating of the paste, its organic components are removed and sintering of the nanoparticles becomes activated, i.e. the particles aggregate and coalesce. This way, bonding between the individual particles and to the component surfaces is achieved. Up to now, especially Ag-based nanopastes are commercially available. Other nanopastes, e.g. for high-temperature applications, are in development.



Sintering with Ag-nanopaste: typical temperature profile

SEM image of the joining zone after a pressure-free sinter-bonding process featuring coarsened Ag-grains with micro-scale size and residual porosity (prepared with a cross-section polisher)



Schematic setup for a sinter-bond joint between a glass chip and a silicon substrate. Both components are metallised with Ni.

Advantages (Ag-nanopastes)

- very high electrical conductivity
- very high thermal conductivity
- high temperature stability in comparison to Sn-based solders
- Temperature profile and process comparable to Sn-solder pastes

Typical applications

- Ag: Joining of components for high-power electronics (die attach or assembly groups on heat sinks)
- Cu: all-Cu interconnects (in evaluation)

Our expertise

- Development of joining processes with commercial nanopastes
- Nanopastes with tailored properties (under development)

Contact

Bastian Rheingans
 Mail: bastian.rheingans@empa.ch
 Tel.: +41 58 765 4371

Jolanta Janczak-Rusch
 Mail: jolanta.janczak@empa.ch
 Tel : +41 58 765 4529

Lars Jeurgens
 Mail: lars.jeurgens@empa.ch
 Tel : +41 58 765 4053