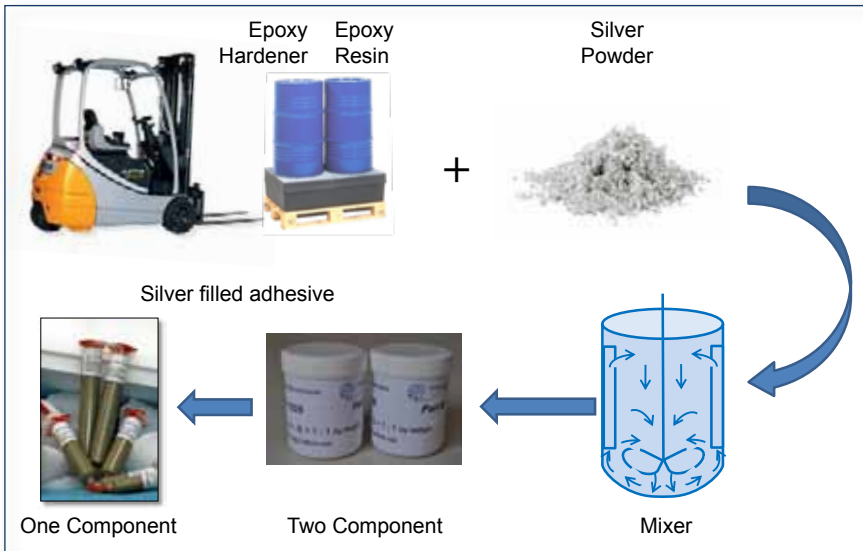




Electrically conductive adhesives for PV applications



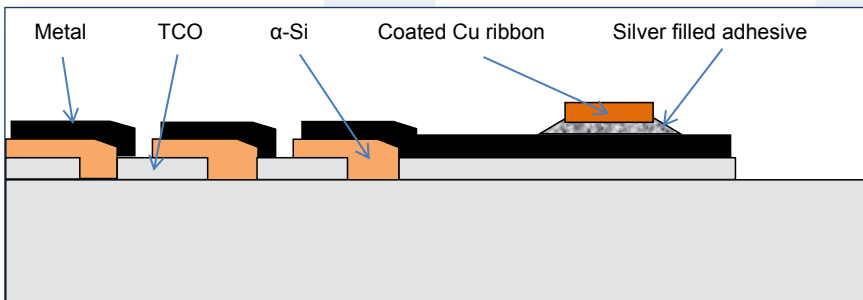
Manufacturing process



Electrically conductive adhesives

for thin film PV applications

- ▶ Manufacturing site locates in South Western part of Germany
- ▶ Focused on electrically conductive adhesives only
- ▶ Key personnel with long experience in conductive adhesives
- ▶ Qualified supplier for several thinfilm manufacturers worldwide

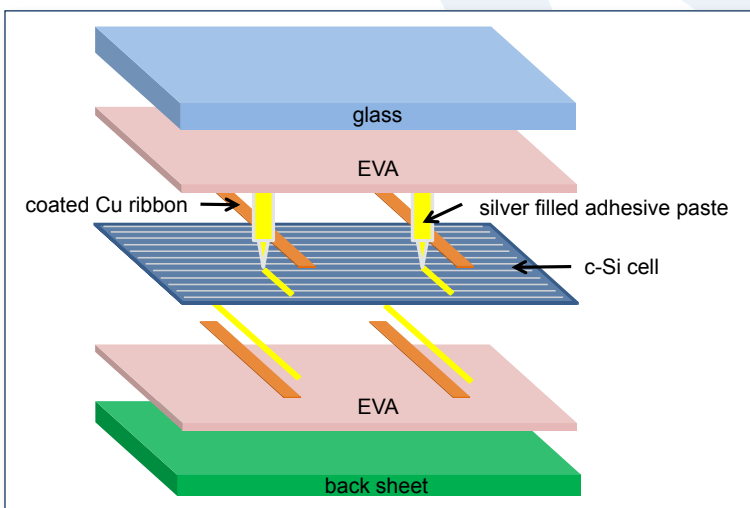


Typically usage of silver filled adhesive on glass substrates

Low total cost of ownership

Electrically conductive adhesives

for standard c-Si modules

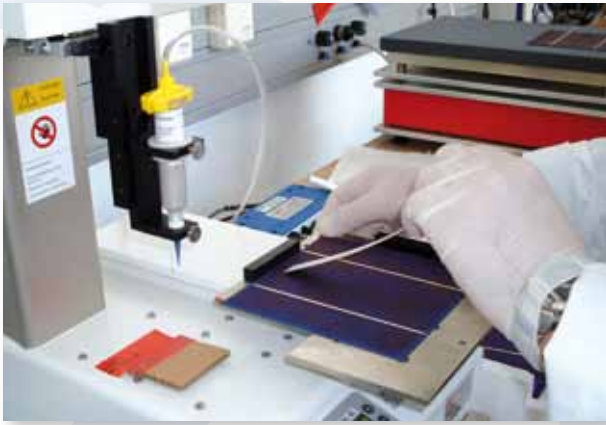


Typically usage of silver filled adhesive on c-Si cells

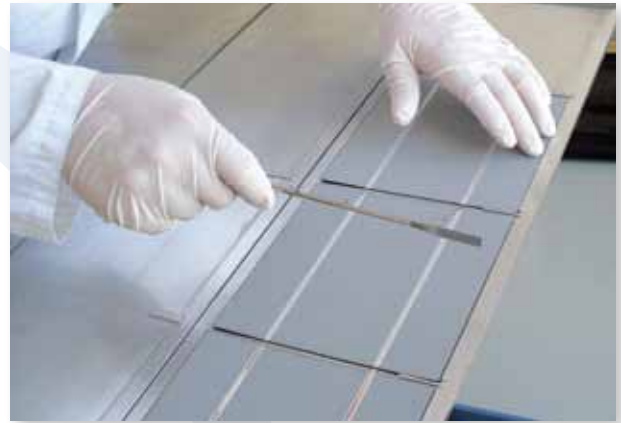
Low cost, high performance



Polished cut section of contact on c-Si



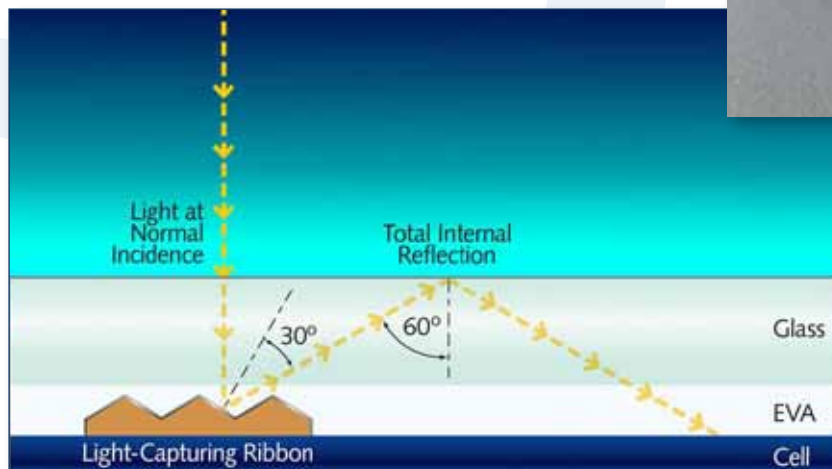
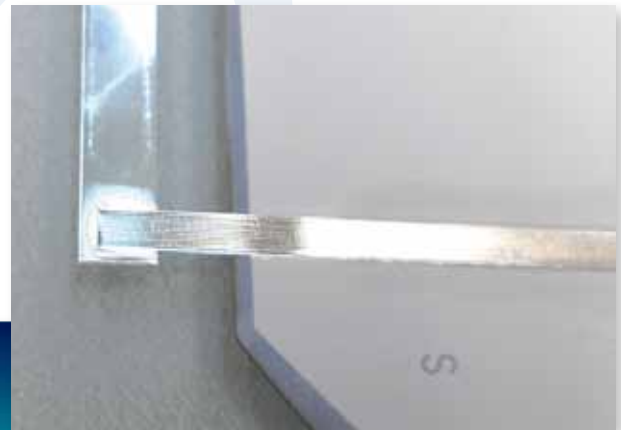
Dispensing of one component adhesive on bus bars



Manual stringing process (Lab scale / R&D)

Adhesive technology versus soldering

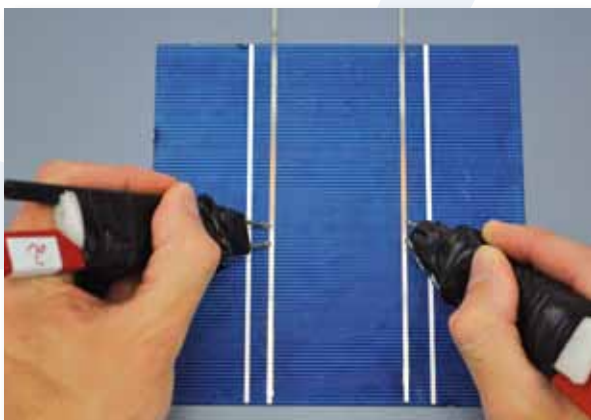
- ▶ Low process temperature below 150 °C
- ▶ Low stress caused by CTE mismatch
- ▶ Low stress because initial plastic flow of adhesive
- ▶ Larger cell size possible
- ▶ Thinner cells possible
- ▶ No pressing force during curing
- ▶ No bus bar needed – just adhesive on finger
- ▶ Reliable 24/7 processability
- ▶ For back contact cells
- ▶ For heterojunction cells
- ▶ For easily use of Light-Capturing Ribbon
- ▶ Lead free



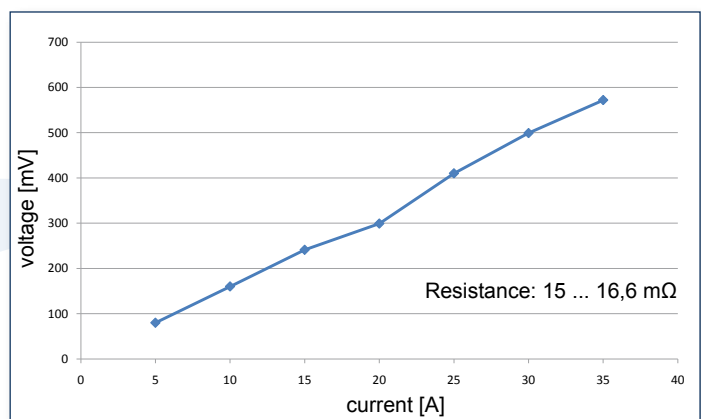
Reliable contacting of Light-Capturing Ribbon with conductive adhesive

Reliable contact surfaces for silver filled adhesives

- ▶ Ag paste
- ▶ AgAl paste
- ▶ Low temperature paste
- ▶ SnPbAg and SnAg coated ribbon
- ▶ TCO, SiN_x



Ampacity testing on finger



Current between ribbons without bus bar on Si-cell surface

Testing according to IEC 6xxxx and UL1703

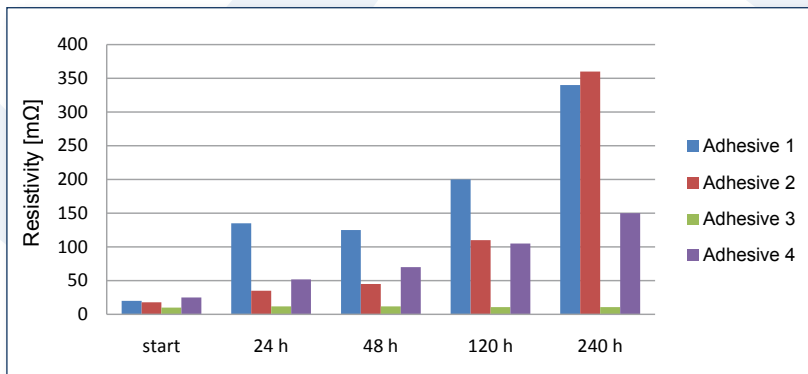
- ▶ Damp heat
- ▶ Humidity freeze
- ▶ Thermal cycling
- ▶ Thermal shock
- ▶ Electrochemical corrosion
- ▶ Current load capacity
- ▶ Peel strength



Lap shear testing



Test chamber for temperature shock



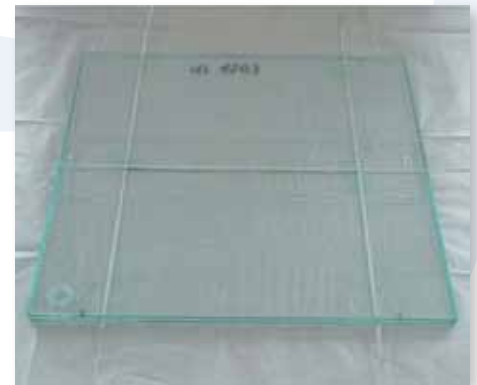
Reliability testing of different adhesives



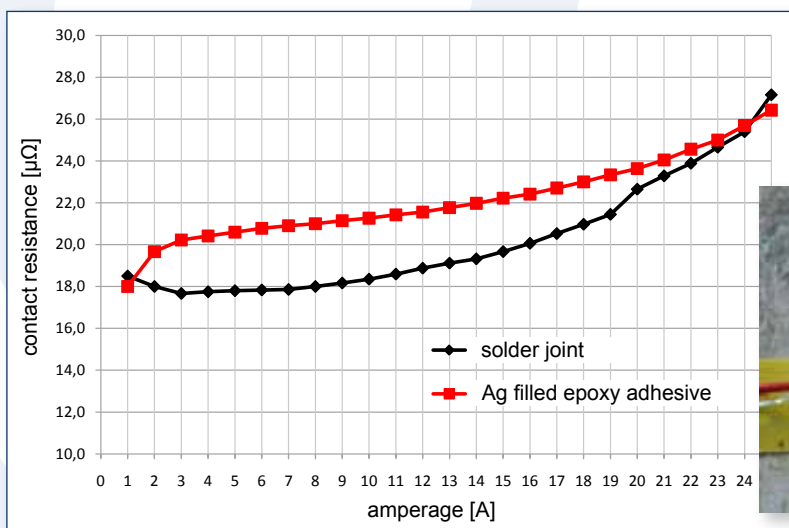
Peel test sample on thin film substrate



Testing of silver filled epoxy vs PSA tape



UL 1703 test sample



Ampacity testing of silver filled adhesives versus solder joint (2x2 mm)

