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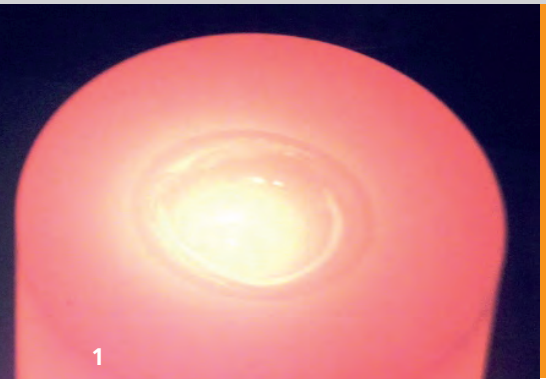
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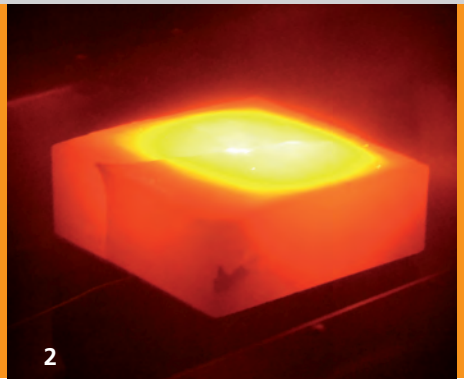
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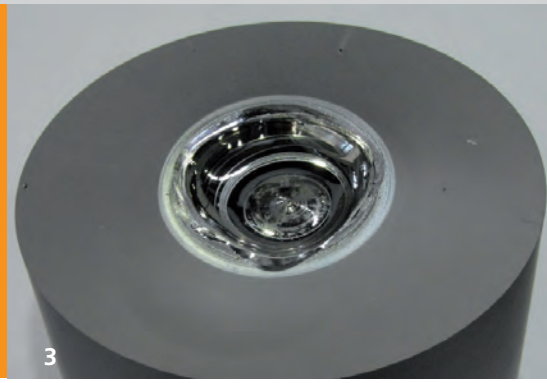
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1 *hot monocrystalline Si brick during evaporation*
2 *hot polycrystalline Si brick during evaporation*
3 *cold monocrystalline Si brick with solidified melt following evaporation*

HIGH-RATE DEPOSITION OF PURE SILICON LAYERS

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Silicon is of interest for many different applications due to its electronic properties as well as due to the diverse effects that result from its being chemically inert.

Silicon layers with suitable thickness as well as sufficient purity are necessary for many applications. A very economic way has been found to meet these requirements based on previous development work at Fraunhofer FEP. High-rate deposition of silicon layers by means of electron beam evaporation is not only attractive from an economic point of view, but also because of the high level of purity that can be achieved by this method at the same time.

Application examples

Si coating
- high-purity
- high-rate
- heat resistance
- large surfaces

Semiconductor technology
- barrier coatings for susceptors
- functional layers for devices
- silicon-on-insulator

Photovoltaics
- PV absorber layers

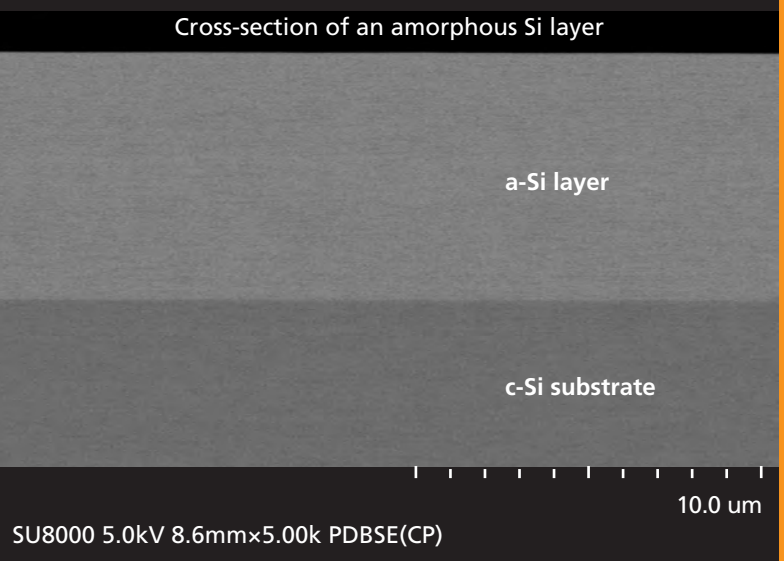
Ionizing radiation
- protective coatings for X-ray and sensor windows and seals

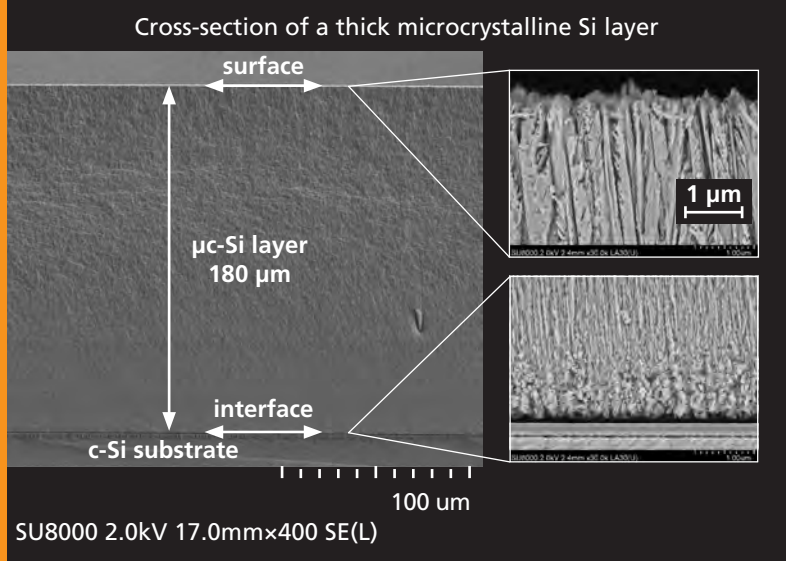
Battery technology
- high-porosity anode materials

Aerospace technology
- protective coatings, hermetic sealing
- thermal insulation
- shielding against external influences

Microsystems engineering
- sensors
- actuators
- oscillators

Vacuum engineering
- surface refinement
- corrosions protection





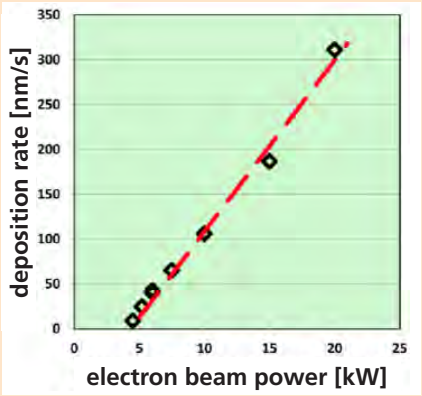
Properties

- high deposition rates (> 300 nm/s) [see Fig. 4]
- coating of large areas (coating widths > 300 mm) [see Fig. 5]
- layer thickness > 180 µm
- low risk of external contaminant ingress
- high purity of layers with sufficient low metallic contamination (Fe: < 5 × 10^{14} cm^{-3}, Cu: < 3 × 10^{14} cm^{-3}) [see Fig. 6]
- low processing temperatures feasible (< 300°C)
- hydrogen-free layers
- dense or porous layers (depending on requirements)
- amorphous, microcrystalline, and polycrystalline structure (depending on requirements)

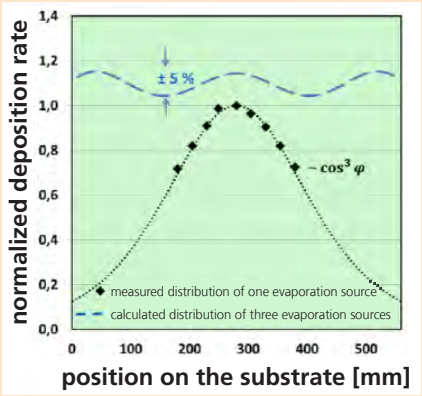
Substrates

- graphite components and films
- stainless steel and other metals
- crystalline substrates (silicon and sapphire wafers)
- glass
- ceramic
- piezoelectric materials

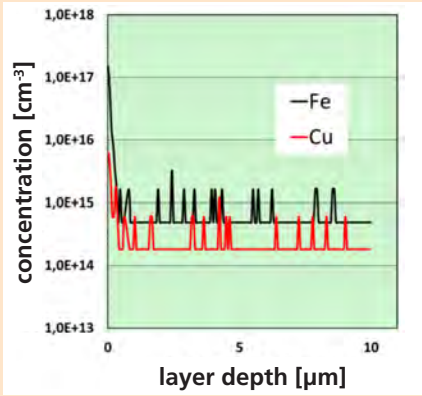
4 Dependence of Si deposition rate on electron beam power



5 Normalized lateral distribution of the Si deposition rate for single and multiple evaporation sources



6 Concentration depth profile of Si layer



What we provide

- feasibility studies
- technology development
  - determining optimal process parameters
- integration of pre- and post-processing is available
- pilot experiments
- analytical capabilities for processes and products at all stages
- comprehensive customer support right through to realisation of facilities
  - design and construction of specific system components
  - adaptation and installation into new or existing production facilities
  - technical maintenance of facilities
  - long-term collaboration for development of new or existing products, or exchange of facility components

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