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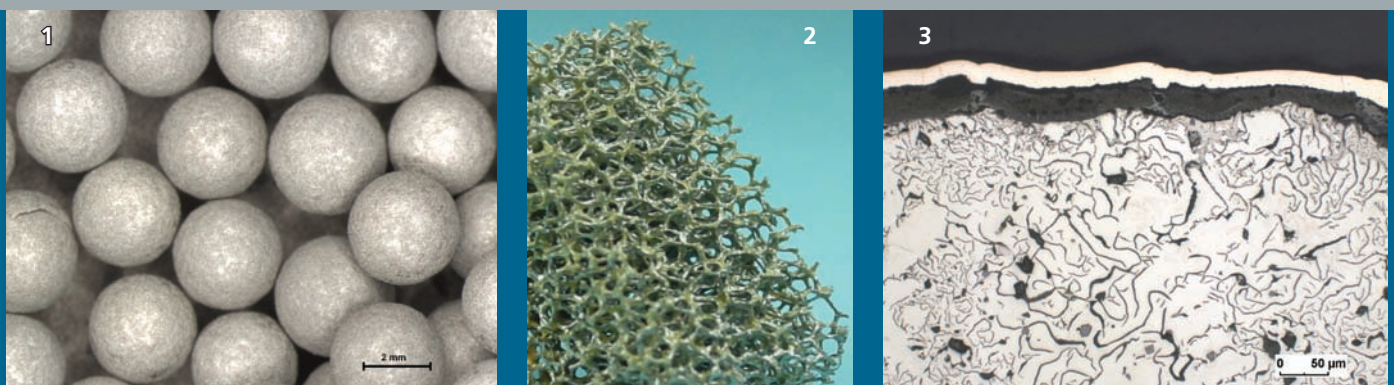

1 *Highly porous bioglass coating on metal hollow spheres (316L)*
2 *TiO_2 coating on open cell metal foam (316L)*
3 *Filled SiCN coating for high temperature protection of steel (316L)*

FUNCTIONAL COATINGS AND SURFACE TECHNOLOGY

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At the Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM in Dresden special, cost-efficient processes for a reproducible coating of component parts, also with complex geometries, are developed. The institute focuses on the development of novel technologies to improve performance and functionality of metallic materials significantly (e.g. temperature and corrosion resistance, specific surface area, bio functionalization, catalytic activity and selectivity, sensor properties etc.). In particular, wet chemical processes are used to produce the coatings, such as Liquid Phase Deposition (LPD) like dip-coating or spray-coating. If necessary, other techniques such as chemical vapor deposition (CVD) or galvanic processes can be applied.

Fields of Application

- **Oxidation and corrosion protection**

Functional coatings allow for the application of the coated materials at elevated temperatures and under corrosive conditions.

- **Catalyst technology**

Combined lightweight, ductile catalyst supports with highly porous coatings with high surface area and defined pore size.

- **Adsorption**

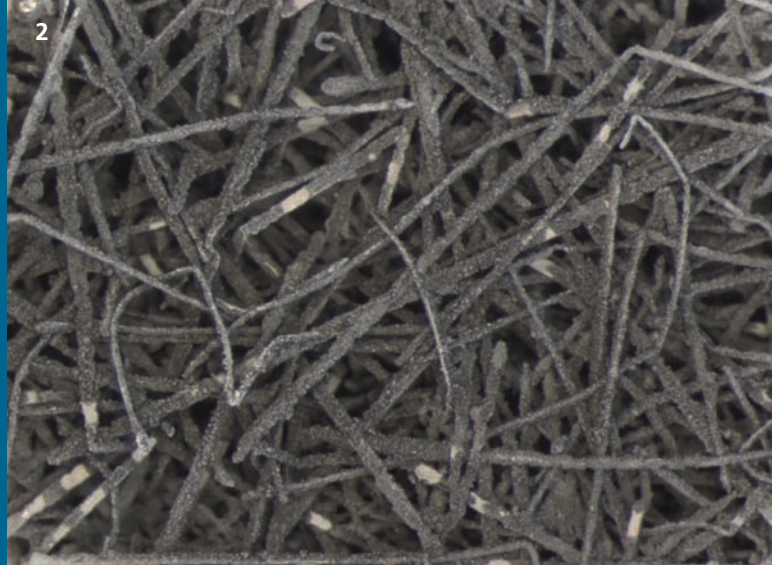
Permeable high-surface materials for gas drying and cleaning.

- **Medical**

Permanent or degradable coatings for implants.

- **Biotechnology and food engineering**

Immobilization of microorganisms and enzymes.



- Sensors

Gas analysis and process monitoring.

- Chemical process engineering

Highly porous coatings with defined pore size and form as micro reactors.

- Interface Material

Interface layer with tailored electrical and thermal conductivity or insulation properties.

Technology

Liquid Phase Deposition (LPD)

Low cost method - well known from lacquer technology - allows for the coating of bigger parts with difficult geometry.

- Dip-Coating
- Spray-Coating
- Sol / Gel - Methods

Microstructure

Diffusion of elements from the coating into the substrate leads to the formation of an interface layer, the reason for the good adhesion.

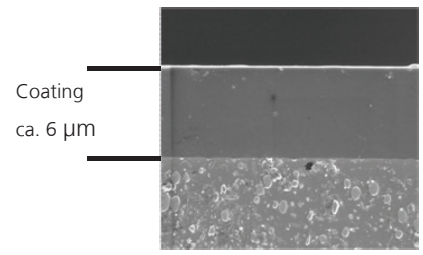


Fig. 1 SiCN coating on titanium substrate

Material

Substrate structures

- Open cell metal foams, metal hollow spheres, sintered hollow sphere structures, metallic fiber structures.
- Metallic sheets and profiles.

Coating materials (Precursors)

- Inorganic polymers: polysilazanes; polysiloxanes, polycarbosilanes
- Metal alkoxides ($M(OR)_x$)
  M = Si, Al, Ti, Zr…
- Bioglasses

Filler systems

The usage of filler systems extends the functionalities of the coatings such as thermal expansion, hardness, electrical and thermal conductivity. The filler system is being developed individually for each application.

Properties

- Dense or porous ceramic or hybrid organic-inorganic coatings
- Thickness: 100 nm to 200 µm
- Very good adhesion on the substrate
- High-temperature stable
- Oxidation and corrosion resistant
- Pore size and form tunable

Example

Dense SiCN - coating

Coating material: SiCN - ceramic from polysilazane
Substrate: sintered hollow sphere structure; material 1.4767 (Fe-20Cr-6Al)
Coating thickness: 7 µm

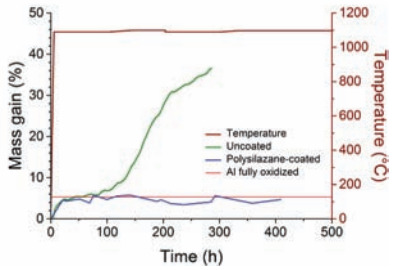


Fig. 2 Oxidation test: 1,100 °C, air, 400 h

Highly porous ceramic coatings

Substrate: metal hollow spheres, 316L
Coating thickness: 10 µm

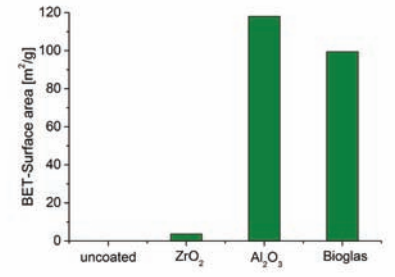


Fig. 3 BET surface area of coated metallic hollow spheres after pyrolysis at 800 °C

1 *Highly porous bioglass coating*
2 *AgO coating on sintered metallic fiber structure (catalyst support)*