

Functional material

Metal foam materials for electrode applications

Tailored solutions for optimal surfaces

Open porous metallic foams have an outstanding potential to combine material properties with a functionality resulting from their specific morphology.

Fraunhofer IFAM Dresden has longstanding experience in customizing commercially available element foams to satisfy the highest demands. Special coating technologies and heat treatments were developed to establish passivation of functional layers to ensure an outstanding durability and high reactivity. Moreover, through our close co-operation with our industry partner Alantum, we have a reliable partner for the supply of high-quality foams, upscaling and industrial production of open metal foam materials.

If you have any questions or specific challenges, please do not hesitate to contact us. We will find the best solution for you.

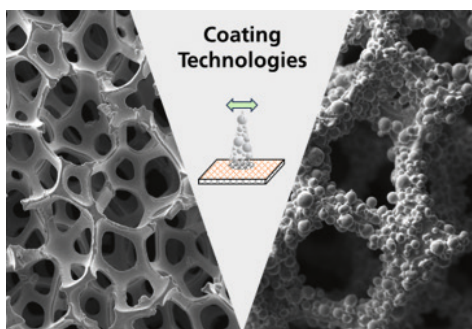


Fig. 1 Change in morphology from raw foam (left) to coated foam (right).



Fig. 2 Examples of electrodes (Ag, Cu, Fe, Ni, Co or alloy) in cooperation with Alantum.

Material characteristics

Materials

- Ni, Fe, Cu, Co, Ag
- Ni-based superalloys e.g. INCONEL 625
- NiCrAl, NiFeCrAl, FeCrAl, NiAl, NiMo, NiFe, Monel
- Raney Ni, Raney NiMo
- 316L, 310SS

Further foam alloys are continuously under development with respect to customer requests.

Geometric dimension

- Pore sizes: 450 to ca. 3000 μm
- Porosity: > 92 %
- Density: 0.4 - 0.7 g/cm^3
- Dimension: up to 400 mm width and 1500 mm length, thickness 1.6 to 4.5 mm depending on pore size

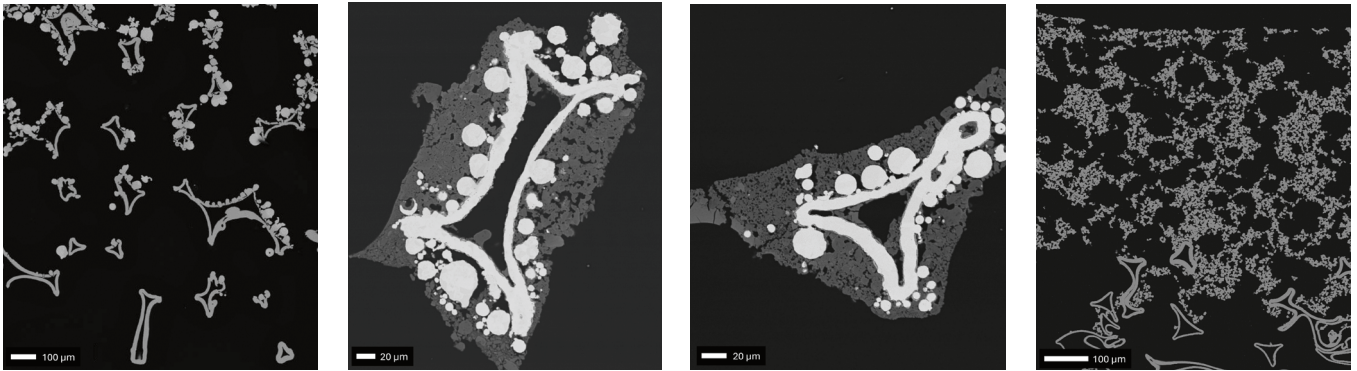


Fig. 3 Resulting microstructures after coating process: Graded alloy formation, metal foam printed with powder paste, active washcoat, powder foam compound (from left to right).

Advantages

- High surface area available
- Three-dimensional metal foam structure results in excellent contact between electrodes and active materials
- Cost-efficient due to larger electrodes giving higher efficiency and lower packaging effort
- Good heat conductivity and heat distribution
- Remaining pores after infiltration of active material achievable by electrolyte
- Geometry and shape can be applied as necessary
- Commercial production for customer-tailored solutions available
- High design flexibility and workability
- Foam alloy is adjustable to the respective application and operation conditions (e.g. corrosive electrolytes or interactions with active materials)

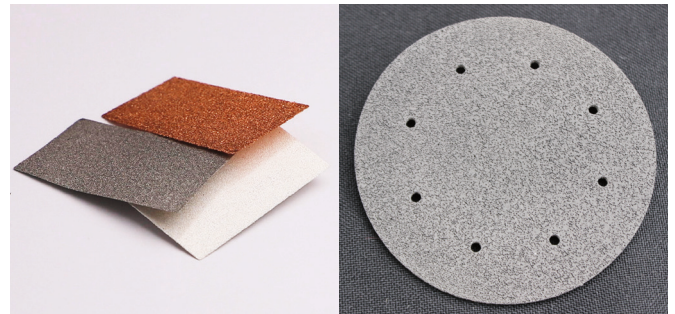


Fig. 5 Porous metal foils for electrode application (left) and potential electrode layout (right).

Application potential

- Electrodes for batteries and super-capacitors
- Electrodes for fuel cells and electrolysis

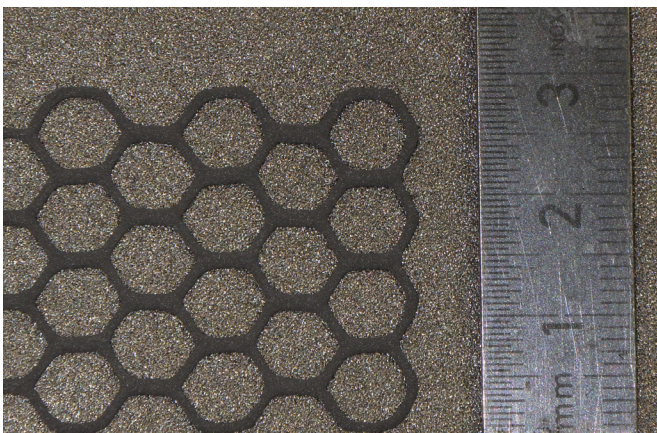


Fig. 4 Space resolved electrode: Coating process only at selected locations, pattern is flexible.

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