Electrophoretic deposition of ceramics

Electrophoretic deposition represents an interesting and beneficial process among ceramic coating technologies. Both, thin and thick films can be deposited homogeneously, well defined and cost-effectively on different conductive materials, almost independent on the complexity of their shape. Thus, surfaces can be functionalized regarding specific electric, mechanical, thermal, catalytic or biological properties. Applications range from monolithic coatings and laminates to dispersion coatings and (nano-) composites. Also, near-net-shaped ceramics can be manufactured by deposition of thick films on prepared substrates («body shaping»).

The electrophoretic deposition of ceramics is based on the suspension of ceramic particles in a solvent, which results in a surface charge and gives a reason for their migration towards an adverse charged electrode. The particles discharge and coagulate near the electrode surface, building up a continuous coating.

![Fig. 1: Bench scale electrodeposition of dispersion coatings](image)

Properties like coating thickness, coating homogeneity and microstructure can be well controlled by the choice of primary materials, solvent / electrolyte composition and variance of process parameters like applied potential, current density, deposition time, temperature and agitation. At the same time electrophoretic deposition features high deposition rates, mild working temperatures and offers simple methods for up-scaling. Bench-scale test rigs are being carried out on site for evaluation and optimization of different process parameters (Fig. 1). Latest projects use these data to implement them into pilot-plant scale.

![Fig. 2: Functional graded Ni/YSZ-coating with dyed YSZ-particles](image)

Moreover recent research focus on functionally graded coatings (FGC) or dispersion coatings. FCGs stand out due to their excellent mechanical properties and high corrosion and abrasion resistance. Due to the graded structure they significantly reduce the coatings delamination tendency. First promising results (Fig. 2) are being used for the development of a novel concept of thermal barrier coatings on turbine blades and vanes.