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Industrial scale synthesis of PVD coatings relevant for energy conversion

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Electricity-hydrogen conversion and vice versa in an energy-efficient way is of utmost importance for going beyond simple consumption of fossil fuels. Different technologies are available e.g. electrolysis of water, PEM fuel cells, and Solid Oxide Fuel Cells (SOFC). The presentation will show different PVD-based coatings synthesized on an industrial scale CemeConCC800/9 deposition unit equipped with four Pulse-DC cathodes.The presentation will focus on the development of high surface-area Raney Nickel electrodes for electrolysis made from a combination of galvanic deposition of Nickel followed by PVD alumina, alloy formation and subsequent dissolution of the alumina forming a high surface area Ranaynickel electrode,. The morphology of the nickel electrode and performance will be addressed. We demonstrate reactive PVD synthesis of gadolinia-doped ceria (CGO) barrier-layer, preventing strontium interdiffusion in SOFC cells. The performance in real SOFC applications will be addressed as well as the underlying microstructure based on FIB-SEM, TEM and XRD. For example, TEM and electron diffraction show that the orientation of the grains in the underlying cathode determines the orientation of the CGO. For thin CGO layers, we observe grain-boundary diffusion of Sr and subsequent formation of the high-resistivity $SrZrO_3$ phase, while thicker CGO layers are observed to block this mechanism.

Keywords
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