

Deposition of YSZ barrier layers on Steel for Interconnects

Yttria-stabilized zirconia (YSZ) was already used in the DLR plasma-spray concept SOFC as a barrier and insulation layer in stacks and has shown advantageous properties with regards to corrosion and reduction of materials diffusion. Also glass seal normally bonds better to ceramic surfaces than to metals. Therefore the idea was to introduce such an YSZ-layer in the SolidPower stack to improve durability. The aim was to apply a layer thickness of 60-80 μm in order to achieve a layer that would be gas tight so no oxygen would be in direct contact to the metal surface and also to be electronically insulating.

Samples of the K41X steel were supplied by UNIGE to DLR. The steel was cut to squares with a size of 50x50 mm. In order to improve adhesion of the layer the samples were sand-blasted and then a thin 8 mol% YSZ was applied by atmospheric plasma spraying (APS). APS is a well established process for the production of ceramic layers on a variety of substrates and is much cheaper than competing vacuum processes like vacuum plasma spraying (VPS) or PVD or CVD. After plasma-spraying the samples were delivered to UNIGE for further evaluation.

The DLR spray equipment consists of an Oerlikon-Metco Triplex plasma torch mounted to a robot in a vented chamber. The power setting was 77 kW and the torch ran on argon and hydrogen as plasma gases. Standard 8YSZ powder (Medipure 8YSZ 10-2247) was used to manufacture the samples. Based on previous experiments with the powder on steel substrates it was decided to apply 12 layers of 8YSZ. The deposited layer had a thickness of about 70 μm which was well within the planned range.

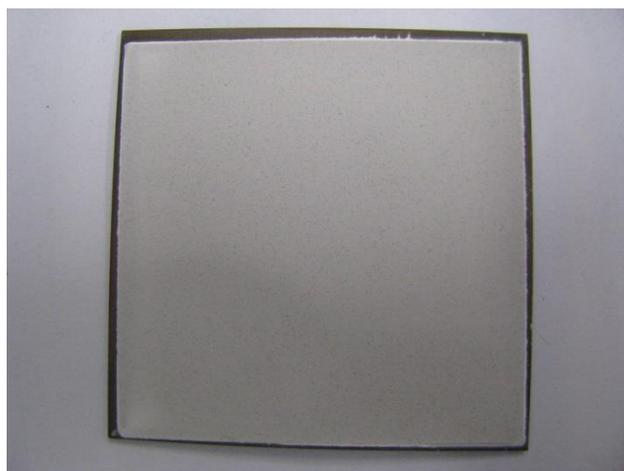


Figure: Steel sample with plasma-sprayed 8YSZ layer