D3.2 – Optimal coating compositions deposition parameters for the air and fuel side

Project information

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1. Abstract

This is deliverable reports the optimized PVD parameters for composites coating on fuel and air electrode interconnectors. PVD or more specifically magnetron sputter deposition is a well-known and mature method for obtaining high quality thin film coatings. It has been used to make coatings for many applications, such as optical, wear resistive, tribological and protective coatings. In all cases, the quality and properties of the thin film layers can be tailored by adjusting sputtering parameters. The most important parameters being gas pressure, bias voltage, substrate temperature and the reactive gas partial pressure, if oxide or nitride layers are deposited. Within the scope of PilostSOEL project, NACO Technologies is worked on adjusting the deposition parameters in order to obtain dense, stable in high temperature, conductive protective coatings of Ni (fuel side) and $MnCO_x$ composites (air side) for interconnector plates.

Two types of protective coating materials are needed for the PilotSOEL project: metallic coatings for the fuel side of interconnects and oxide coatings for air side of interconnects. The metallic coatings are a straightforward task, as the sputtering can be carried out in a pure argon atmosphere and direct current power sources can be used. It is slightly more challenging to make the oxide coating for air side of the interconnector plates. In the latter case, the target is run in argon atmosphere and the needed oxygen is added at the substrate site, where the coating undergoes a chemical reaction – oxidation. If an insufficient amount of oxygen is supplied the needed stoichiometry will not be achieved and the coating will be a sub-oxide. If too much oxygen is introduced to the deposition chamber it can start to react with the metallic sputtering target and oxidize its surface. In such a situation, the deposition rate drops significantly and in some cases the deposition can stop altogether.

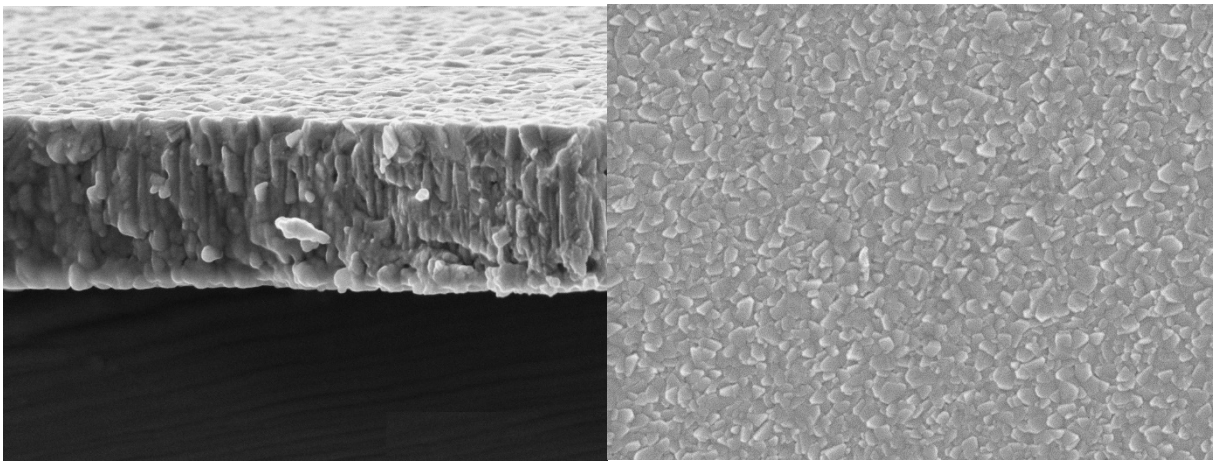

Figure 1magnetron sputtered $MnCoO_x$ coatings, left -cross-section of oxide coating, right -top view of the oxide coating

By carefully adjusting the oxygen levels, Together with Elcogen OY, Naco has deposited stochiometric dense layers that offer good corrosion resistance for the interconnector plates. Besides density and

stoichiometry, other parameters such as adhesion of the coating to the steel plates and low defect presence in the coatings are crucial for high corrosion resistance., Preliminary results show that the coatings have low contact resistance (below 5 $m\Omega \cdot cm^2$) and perform well in solid oxide electrolyser environment. Long term performance of the coating quality is under test and will be presented in another deliverable in the PilotSOEL project.