Poster-Session

Characterization and Verification of Metal Doped DLC coatings using Hybrid HIPIMS / DC Pulsed Mode for the Bipolar Plates application in PEMWE

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One of the key elements of the PEMWE cell is the bipolar plate (BPP). BPPs are responsible for the charge transport and the mechanical integrity of the cell. High electrical conductivity, strong mechanical stability, low contact resistance particularly to electrodes, high acidic medium resistance, and a high hydrogen evolution potential are all crucial for the design and development of BPPs. It should be lightweight as BPPs occupy ~ 60% of the weight and the cost is ~ 30% of the total cost of PEMWE cell. In this study, as an alternative to traditional bipolar plates for PEMWE applications, metal doped DLC coated SS substrates (316L and M2) were produced by a physical vapor deposition.
In our approach, the DLC coating formulations are applied using a hybrid HIPIMS/DC pulsed industrial scale setup with 500/300 mm H/W effective working volume. The Me-doped DLC coatings (Me=Cr) were deposited to 316L stainless steel using a DC_pulsed / HIPIMS hybrid configuration using C and Cr targets respectively, both placed in opposition around the sample holder volume. The coatings were evaluated for various HIPMIS power conditions (on the Cr target), while the DC_pulse power on the C target was kept constant. Cladding layers based on Cr-CrN were implemented to enhance the adhesion strength of the films.
The coatings microstructure has been studies by using x-ray diffraction and scanning electron microscopy with top and cross-sectional views. The total mechanical characteristics at room temperature were framed using nano-indentation hardness and standard wear rate tests. The major emphasis of our research on metallic bipolar plates was the hydrogen evolution reaction (HER) and the stability of anodic corrosion in diluted sulfuric acid. The Cr-DLC on 316L, will be evaluated for the hydrogen evolution overpotential and additionally, the corrosion resistance for anodic potentials will be measured.