

Workshop »Coatings for Energy Technologies«

Efficient metal Plate Coating Solutions for Hydrogen Applications

Dr. Torbjörn Joelsson, Dr. Axel Flink, Dr. Christian Ulrich

Impact Coatings AB, Linköping

torbjorn.joelsson@impactcoatings.com

During the last decades, demands for both production of hydrogen using electrolysis, and power units transferring hydrogen to electricity with fuel cells, have become important topics. One promising technology is the PEM (Proton-Exchange Membrane or Polymer Electrolyte Membrane) based system, both for production of hydrogen from water and production of electricity from hydrogen. The PEM systems all rely on multiple plates acting as anode and cathode arranged in a stack. These plates could be made of metal or graphite. Metal plates are the emerging solution from a production point of view, due to the high power density, low cost and less size. The dominant choices for metal plates are titanium and stainless steel. However, due to the operational conditions, efficiency, and to assure a long lifetime, a surface treatment, such as a PVD coating, will be necessary.

Since the operational conditions in an electrolysis unit and a fuel cell are different, the suitable PVD coating will be different. However, the demands on the tool applying the coating will be similar and preferably be designed to coat flat objects, such as monopolar or bipolar plates. The plates could be coated from both sides or single sided, and furthermore, the same coating could be applied on both sides or different coatings with tailored properties on each side.

We present a combination of a suitable tool, the INLINECOATER™, which is capable of a throughput of up to 3 million plates per year depending on size and process, and coating processes for both fuel cells and electrolysis. The main characteristic of the INLINECOATER™ is that it consists of three coating chambers and one loading chamber. This arrangement enables the possibility to run up to three different processes in parallel while simultaneously loading the tool. The INLINECOATER™ is suitable to integrate in a production line via a robot handling system feeding the tool. The INLINECOATER™ comes in three different sizes, all relying on the same structural arrangement and the same type of sources. This makes it easy to transfer processes between the different sizes. The main sources used for this kind of application are DC Arc evaporation and DC Magnetron sputtering. However, the modular concept of the tool enables the use of other coating technologies, such as PECVD, HIPIMS, MF, RF sputtering etc.

For standard fuel cell applications, we have worked with our Ceramic MAXPHASE™ coating, which meets the requirements in the standard DOE test protocol. However, during recent years there has been an increasing demand for plates that can withstand higher voltages during the test sequence. To meet this demand, we have developed and introduced a new coating in our portfolio together with the INLINECOATER™ family.

With respect to electrolysis, we offer coatings of gold and platinum, or a combination of both. These coatings could be applied to all metal-based plates in the electrolysis stack.