Workshop »Coatings for Energy Technologies«

Plasma coating technologies: Unlocking GW-size electrolyser manufacturing capacity in the EU

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Climate change is the biggest challenge of our times. And it is an opportunity to build a new economic model. The European Green Deal[1] set the blueprint for this transformational change. All 27 EU Member States committed to turning the EU into the first climate neutral continent by 2050. To get there, they pledged to reduce emissions by at least 55 % by 2030, compared to 1990 levels. Similarly, the number of countries announcing pledges to achieve net zero emissions (NZE) over the coming decades continues to grow. NZE accomplishment by 2050[2] requires huge leaps in clean energy innovation where biggest opportunities concern batteries, hydrogen electrolysers and direct air capture storage. Key milestones in the pathway to NZE identified by the IEA (International Energy Agency) are the installation of 850 GW and 3000 GW electrolyser capacity by 2030 and 2050, respectively, up from around 0.3 GW today. To reach 2030 targets, 100 GW/year electrolyser capacity must be installed during this decade. At European level, the installation of around 80 GW electrolyser capacity by 2030 that would generate 10 million tons of green H2 is expected according to a European Green Deal A 2x40 GW Initiative[3] and REPowerEU[4] plans. To achieve such ambitious objectives, water electrolysis technologies must reach mass market deployment. In addition to regulations and market design, the cost of green hydrogen produced must be competitive with grey hydrogen generated using Methane Steam Reforming (SMR). To produce competitive green hydrogen at required capacity, low renewable electricity price is necessary but an aggressive CAPEX and OPEX reduction is essential, besides industrialization of GW-size electrolyser manufacturing processes. In this context, The European Commission has recently established The Green Deal Industrial Plan aiming at least 50 % of the green hydrogen consumed in the EU each year to be produced using electrolysers made in Europe by 2030[5]. This presentation will give an overview of the multiple options of plasma coating technologies to cover the huge demand of protective coating fabrication for bipolar plates and porous transport layers and catalyst layer deposition for next generation electrodes in low temperature water electrolysers. Specifically, alkaline water electrolysers (AWE) do suffer from strong degradation due to inefficient Nickel Raney electrodes when operating at dynamic regime expected when coupled with renewable energy intermittent generation. Polymer electrolyte membrane (PEM) water electrolysers respond effectively to power fluctuations but due to aggressive operating environment expensive and scarce materials (like Platinum and Iridium) are needed to achieve high efficiencies. Recently developed anion exchange membrane (AEM) water electrolysis the least-mature technology, and prior to implementation, significant technological hurdles need to be overcome. The challenges for each electrolysis technology will be described and current solutions offered by plasma coating technologies accurately detailed.

[1] EUR-Lex - 52019DC0640 - EN - EUR-Lex (europa.eu)
[2] Net Zero by 2050 – Analysis - IEA
[3] 2020-04-01_Dii_Hydrogen_Studie2020_v13_SP.pdf (dii-desertenergy.org)
[4] 2022.05.16_HE_PositionPaper_REPowerEU.pdf (hydrogeneurope.eu)
[5] The Green Deal Industrial Plan (europa.eu)