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Abstract Formulary

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Title: Biopolymer-derived carbon aerogels as catalyst support for hydrogen generation cathodes (CarboCAT)

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ABSTRACT (Space limited to 2200 characters)

Hydrogen plays a key role to master the energy transition and thus contribute to the environmental goals of the EU. In Power-to-X concepts, renewable energies are utilized to generate green hydrogen by the electrolysis of water. A crucial step to increase the competitiveness of green hydrogen in industrial scale is to multiply electrolyser plant capacities from to current MW scale to GW scale. Electroylsers of the Proton-Exchange-Membrane (PEM) type are regarded as a promising technology to realize this scale-up. However, state of the art membrane electrode assemblies (MEAs) in PEMs still suffer from requiring high platinum contents in their electrocatalytic layers. This is partly due to low mass-specific activity of the platinum in the in the electrode layer, usually made of special industrial carbon blacks loaded with platinum (Pt-C). A combination of carbon aerogels as support and supercritical Pt deposition as catalyst, could significantly lower the Pt demand by increasing the specific activity, as shown in the related field of fuel cell catalysis.
In the international project “CarboCAT” MEAs with novel electrocatalytic layers will be synthesized based on biopolymer-aerogels. Starting from lignocellulosic biomass to create aerogels, which will be pyrolysed and further post-treated with different plasma processes to manipulate the surface properties. Platinum will be added to the carbon support by deposition of (cis,cis-1,5-Cyclooctadien)-dimethylplatin(II) in super critical CO_2. This allows to control the Pt particle size distribution such that ideally 4-7 nm Pt particles are obtained homogeneously distributed in the pores. These novel catalysts will then be screened for HER activity and stability by cyclic voltammetry. Finally, the best performing materials will be used to manufacture PEM membranes for benchmark tests in membrane modules to be evaluated in direct comparison to state of the art Pt-C catalysts for HER.