Evaluating the effect of the dispersion media on the colloidal stability in catalyst inks for PEMFC

MX Semester Project (10 ECTS)

Administrative

Supervision: Jérémie Bonvin, Samaneh Daviran, Prof. J. Van Herle
Contact: jeremie.bonvin@epfl.ch ; samaneh.daviran@epfl.ch ;
Location: Sion
Remarks: If interested, please send your CV, with a short motivation letter, to Jérémie Bonvin

Project description:

Catalyst inks formulation, dispersion and deposition are crucial steps in the manufacturing process of PEM Fuel Cells. Dispersing solvents are well recognized to strongly influence the cells performance by influencing the dispersion (inversely the aggregation) of the particles, the ionomer adsorption (dispersant). Literature is mainly focused and often evaluates the influence of solvents and of the ionomer content on the fuel cells electrochemical performances without prior understanding of the interactions occurring in the colloid. The aim of this project is to investigate the colloidal stability of inks using Zeta-potential measurements and particle size analysis.

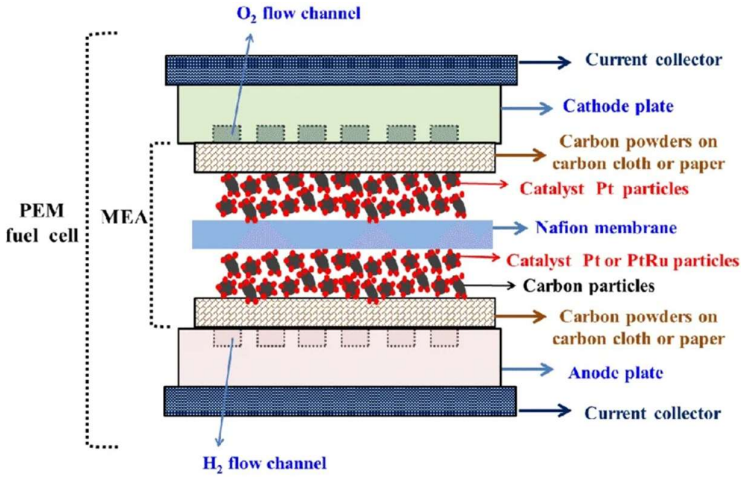

Figure 1: Scheme of PEMFC installed with a membrane electrode assembly (MEA) (Huang et al., 2016)

Your tasks:

- Literature review:
  - Select different solvents mixtures (solvent type and contents) for inks formulations
  - Select pertinent ionomer content range for this study
- Formulates colloids based on Pt-C catalyst powders with the selected solvent mixtures and with varying ionomer content
- Measure the Zeta potential based on electrophoretic technics
- Measure the particle size distribution through dynamic light scattering (DLS)
- Control the effect of ink dilution on the measurements
- Validation of results using xDLVO calculations with Hamaker software.
- Redact a scientific report and presentation based on the results and deliver organized results

Effect of the dispersion protocol on the colloidal stability of PEMFC inks

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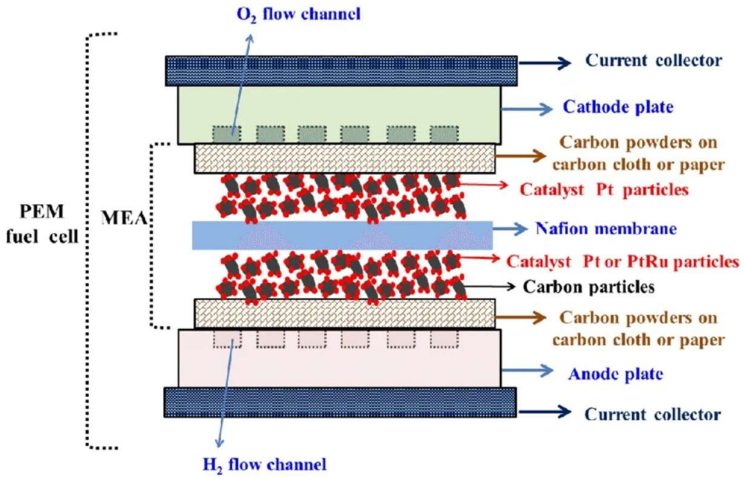

Figure 2: Scheme of PEMFC installed with a membrane electrode assembly (MEA) (Huang et al., 2016)

Your tasks:

- Literature review:
  - Select the solvent mixture (solvent type and contents) for inks formulations
  - Select pertinent ionomer content for this study
- Formulates colloids based on composition selected
- Define and use different dispersion protocols and evaluate the properties of the inks through time
- Measure the Zeta potential based on electrophoretic technics
- Measure the particle size distribution through dynamic light scattering and Laser Diffraction
- Redact a scientific report and presentation based on the results and deliver organized results