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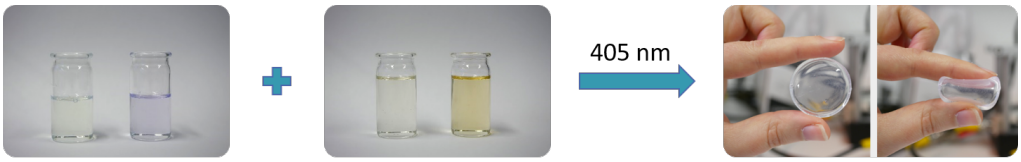
Ionic liquids based materials as electrolytes in fuel cells

Description



monomers | ionic liquids | flexible, transparent IG

Alyna Lange's research in the group of Prof. Andreas Taubert is mainly based on the synthesis, properties and use of ionic liquids (ILs) and their derivatives for the application as electrolytes. ILs are salts which, like our table salt, consist mostly of ions. In contrast to common salts, ILs have a melting point below 100 °C, some are even liquid at room temperature. Moreover these substances have a negligible vapor pressure, are not flammable and show high thermal and electrochemical stability as well as ionic conductivities. These properties make ILs promising candidates as alternative electrolytes for solar cells, batteries or fuel cells. [1] Mrs. Lange primarily works with protic ILs, i. e. ILs with a proton conducting nature. [2-4]
For the application of these ILs in fuel cells an immobilization of the ILs is necessary to prevent leaking and realize proper function. For this, Mrs. Lange works with two of the possible immobilization pathways: the polymerization of IL monomers and the polymerization of polymer monomers in an IL. [5] The resulting hybrid materials are known as ionogels (IGs) which combine the promising electrolyte properties of the ILs with the thermal and mechanical stability of the respective polymers. [1] As a next step the IGs are manufactured in a 3D printing process (SLA). [3] These materials are then analyzed in regards to their structural properties (IR, Raman), thermal (TGA, DSC) and electrochemical stabilities (Cyclic voltammetry), their ion motion (PFG NMR, dielectric spectroscopy) and ionic conductivity behavior (impedance spectroscopy) and application in a real-life fuel cell.

Spectrum of Methods

Synthesis – Infrared spectroscopy (IR) – Raman spectroscopy – thermogravimetrical analysis (TGA) – differential scanning calorimetry (DSC) – high pressure liquid chromatography (HPLC) – cyclic voltammetry (CV) – dielectric spectroscopy – impedance spectroscopy – 3D printing (stereolithography)

Literature

[1] J. Le Bideau, L. Viau, A. Vioux, *Chem. Soc. Rev.*, **2011**, *40*, 907–925.
[2] M. Martinez, et al., *Journal of Power Sources*, **2010**, *195*, 5829–5839.
[3] K. Zehbe, et al., *Energy Fuels*, **2019**, *33*, 12885-12893.
[4] Z. Wojnarowska, et al., *ACS Appl. Mater. Interfaces*, **2021**, *13*, 30614–30624.
[5] J. Lu, et al., *Progress in Polymer Science*, **2009**, *34*, 431-448.

Applications
- Electrolyte materials
- Fuel cells
- 3D printing

Keywords
- Ionic liquids
- Ionogels
- Ionic conductivities
- Thermal stabilities
- Stereolithography

Interest in cooperation
- Research-based collaboration
- Contract research
- Industry-sponsored research

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