

MS19-P08**Influence of the glass-ceramic synthesis route on the ionic conductivity of the sodium solid electrolyte Na₂O-Y₂O₃-SiO₂ (NYS)**

Wolfram Münchgesang¹, Dörthe Wagner², Mykhaylo Motylenko³, Jochen Schilm², David Rafaja³, Dirk C. Meyer¹

1. Institute of Experimental Physics - TU Bergakademie Freiberg, Freiberg, Germany
2. Fraunhofer Institute for Ceramic Technologies and Systems IKTS, Dresden, Germany
3. Institute of Materials Science Structure Research - TU Bergakademie Freiberg, Freiberg, Germany

email: wolfram.muenchgesang@physik.tu-freiberg.de

The development of room temperature solid electrolytes (SEs) is one of the keys for the realization of solid-state batteries – a post lithiumion technology, with probably better performance than this. For such a SE, a glass-ceramic synthesis route (GCSR) is particularly suitable, because this is less expensive than other production methods and can be used on an industrial scale. The maximum achievable conductivity (C) of SEs is determined by the used ionic-conductive phase (ICP), in our case this is the crystalline phase Na₃YSi₄O₁₂. The practical C is decisively influenced by the microstructure of the SE, in particular the realization of a suitable percolation path; which is determined by the proportion of the ICP and their crosslinking. We will present the influence of different GCSR on the microstructure of the SE and the resulting conductivity change.

Keywords: sodium solid electrolyte, glass-ceramic synthesis, ionic conductivity

MS19-P09**New insight in the CO₂ photo-activation mechanism in artificial photosynthesis**

Victor Antonio de la Peña O'Shea¹, Fernando Fresno¹, Ignacio Villar¹, Mariam Barawi¹, Patricia Reñones¹, Elena Alfonso¹, Alba García-Sánchez¹, Marta Liras¹, Raúl Pérez¹

1. Photoactivated Processes Unit, IMDEA Energy Institute, Móstoles, Spain

email: victor.delapenya@imdea.org

An interesting route for the valorization of CO₂ consists on its photocatalytic conversion into fuels and/or chemicals in the presence of water and suited photocatalyst [1]; this process is also known as Artificial Photosynthesis (AP). Such conversion is a quite challenging process since CO₂ is a very stable compound and its reduction involves a series of multi-electron reactions. Extensive efforts are focused on improving the photocatalytic efficiencies, especially when using water as the electron donor. Generally, this process suffers from very low quantum yields and non-selective product distributions, due to the complexity of the involved multi-step reactions.

During the last years, a series of innovative materials with versatile properties and multifunctional character, known as hybrid materials, have been developed. Synergistic effects between their components provide these materials with exciting properties for light harvesting and charge separation, fundamental issues in artificial photosynthesis. Therefore, the development of new hybrid multifunctional photocatalysts using sunlight to produce fuels and chemicals is considered as a cornerstone for CO₂ valorisation technologies.

In this work we report different strategies and modifications photocatalysts to increase process performance. The modification of optoelectronic properties of through the use of band gap engineering strategies, allow controlling the absorption of incident photons, redox capabilities and subsequently the photocatalytic performance. In addition, metal nanoparticles act as electron scavenger and as co-catalyst [2-3].

On the other hand, the use of novel hole transport materials maximize the light harvest and charge separation. On the other hand, efforts are devoted to shed light on mechanistic aspects of the reaction. In order to clarify the effect of different parallel and competitive reactions in the activity and products distribution, a series of photocatalytic experiments in combination with operando characterization using synchrotron radiation and laboratory techniques and theoretical calculations were performed.

These studies show that introduction of SPR NPs as co-catalyst or conductive polymers as hole transports leads to changes in the conversion and enhanced selectivity to higher demand electron products, such as CH₄, while the CO and H₂ concentrations decrease.