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Carbon Quantum Dots Based Electrocatalysts for Oxygen and Carbon Dioxide Reduction Reactions

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Extended Abstract

The plenary talk will present the synthesis, characterization and some electrocatalytic applications of carbon quantum dots.

The development of metal-free electrocatalysts for various environmentally relevant electrochemical reactions, such as the oxygen reduction reaction, which is central for energy storage and conversion technologies, such as metal-air batteries or fuel cells, and the carbon dioxide reduction reaction, which can contribute to sustainable and low carbon footprint chemistry.

Carbon quantum dots are nanostructured materials made by several graphite layers with an average size below 10 nm. They can be used as metal-free electrocatalysts for oxygen and carbon dioxide reduction reactions.

We have compared various techniques for the preparation of doped carbon quantum dots, including pyrolysis, microwave processing and hydrothermal synthesis. Hydrothermal synthesis is a particularly attractive technique giving high quality materials [1].

Nitrogen and boron co-doped carbon quantum dots can have a quite high electrocatalytic efficiency for the oxygen reduction reaction in alkaline conditions, especially when mixed with an optimized anion-conducting ionomer binder, which improves the transport of hydroxide ions [2,3].

Carbon quantum dots mixed with copper nanoparticles have a good electrocatalytic activity for the carbon dioxide reaction, giving a high amount of acetic acid together with a smaller amount of formic acid. Quite high Faradaic efficiencies can be obtained.

References

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