

New highly doped carbonaceous materials for electrochemical energy storage and electrocatalysis

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Doped carbonaceous materials have emerged as promising candidates for advanced electrochemical energy storage and electrocatalysis due to their enhanced conductivity, stability, and catalytic activity. Typically, the materials are tuned by introducing heteroatoms such as nitrogen, sulphur, or phosphorus into the carbon matrix, which change the material electron density locally, introduce active sites for different reactions [1], act as binders for metallic active centers [2], and may prevent the material from oxidizing in harsh electrochemical environments. Our ongoing research focuses on optimizing synthesis strategies and understanding structure-property relationships of highly doped carbonaceous materials to improve their performance in different electrochemical and catalytic applications. The group have developed different synthetic strategies to prepare highly oxygen- and nitrogen-doped carbon materials based on precoding information on molecular carbon precursors [3,4]. In this talk, I will discuss our ongoing efforts to understand the interaction of these materials with aqueous solutions using solid-state nuclear magnetic resonance [4], in-situ X-ray photoelectron spectroscopy and sorption analysis. The aim is to extract valuable information on how different functionalizations affect the material's (electro)catalytic performance for technologies using mainly water as a solvent. Interestingly, our findings point to water having trouble accessing small, highly doped pores despite the improved hydrophilicity of larger pores in the materials.

References

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