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Towards an understanding of carbon materials in energy storage applications by X-ray Raman Scattering and optical Raman Spectroscopy

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Due to the growing awareness of environmental concerns and the threat of depleting conventional fossil energy resources, low emission renewable energy processes are required. The key technologies for the energy economy of the 21st century are electrochemical energy conversion and storage technologies, like fuel cells ,lithium ion and redox flow battery systems. Although the mentioned systems are very different in their requirements, they all use carbon materials in the electrodes. In lithium ion and redox flow batteries, carbon is the active material offering functional centers for intercalation and reaction, respectively.
However, in fuel cells the carbon works as catalyst support material anchoring the noble metal nanoparticles. All the processes taking place at the carbon surface are poorly understood
leading to limitations in life time and/or charge/discharge rate in these systems. A better understanding of these processes requires in-situ studies which will further support the
development of new materials. For this we are currently developing a fingerprint method to investigate carbon materials by X-ray Raman Scattering. In this contribution, we will show first ex-situ results of different carbon materials using XRS. In a second step a combination with optical Raman Spectroscopy would be an asset in order to correlate the electronic structure with the disorder
of carbon materials.

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