Elaboration of Carbon/FeS_2 composites and their performance in supercapacitors

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Transition metal sulfides are an interesting family of materials as electrodes for electrochemical supercapacitors owing to their high theoretical specific capacity. Pyrite (FeS_2) is particularly attractive due to its eco-friendly nature and good electronic conductivity.[1] Herein, we choose to combine mesoporous carbon and FeS_2 to provide larger porosity and conductivity. The synthesis consists of mixing green carbon precursors, a sulfur and an iron source in a solvent. The mixture is stirred under fumehood until total solvent evaporation. Then, a thermal treatment of the recovered material under inert atmosphere at 750°C gives FeS/carbon composites. Afterwards, a thermal treatment under H_2S at different temperatures generates FeS_2/carbon composites. An optimization of thermal treatments conditions was performed in order to achieve FeS_2 with different crystallinities. The composites obtained at different sulfurization temperatures were characterized by XRD, Raman, TGA and electronic microscopy. The optimal temperature was found to be 400. The particles of FeS_2 showed a small particle size ~6.5 nm with some aggregates. When tested in a symmetric device, galvanostatic charge discharge revealed good reversibility and a capacitance of 58 F g^{-1} at 0.1 A g^{-1}. Further electrochemical tests will be performed to evaluate the impact of crystalline phase, particle size and porosity on the electrochemical performance.

References:

[1] Y. Gao, L. Zhao, *Chem. Eng. Journal.* **2022**, *430*, 132745.