Nanocomposite Materials for Porous Electrodes based on 2D Transition Metal Dichalcogenides

Felix Boll
Matteo Crisci, Melissa Happel, Leonardo Merola Dr. Teresa Gatti
Center for Materials Research, Justus-Liebig Universität, Heinrich-Buff Ring 17, Giessen, Germany
Felix.Boll@phys.chemie.uni-giessen.de

The search for new energy storage materials is a key point in current materials science investigation. Bidimensional transition metal dichalcogenides (2D TMDs) such as MoS_2 and WS_2 are suitable candidates to deliver high capacitance and energy densities in pseudocapacitive or battery-like electrode materials with long operation lifetimes and low cost, due to the high surface areas and peculiar electronic properties.[1] Their light-weight and suitability for incorporation into composite architectures, might make them also suitable active species into flexible energy storage systems.[2] However, to maintain the wide active area of 2D TMDs when going from a colloidal ink, into which they are contained after liquid phase exfoliation (LPE), to a solid-state electrode architecture, it is necessary to develop effective strategies for the obtainment of porous scaffolds. The production of nanofibers through the highly versatile electrospinning technique is exploited by us to produce similar porous and 2D TMDs-integrating electrodes. To further overcome the low conductivity of these nanomaterials, either carbon nanotubes (CNT) are further incorporated into an electrospun fibrous polymer network, producing flexible free-standing films of a ternary 2D TMD/CNT/polymer composite, or a carbon fibers-based backbone is employed for the anchoring of the LPE 2D TMDs. The thus obtained nanostructured 3D scaffolds are characterized for their capacitive behavior to determine their potential for integration into energy storage devices.

References

[1] Sajedi-Moghaddam, A.; *Nanoscale* **2017**, 9 (24), 8052–8065
[2] Lyu, L. et al. *Small* **2021**, *17* (36), 1–41.
[3] Liu, S. et al.; *J. Mater. Chem. A* **2017**, *5* (40), 21460–21466.

Figures

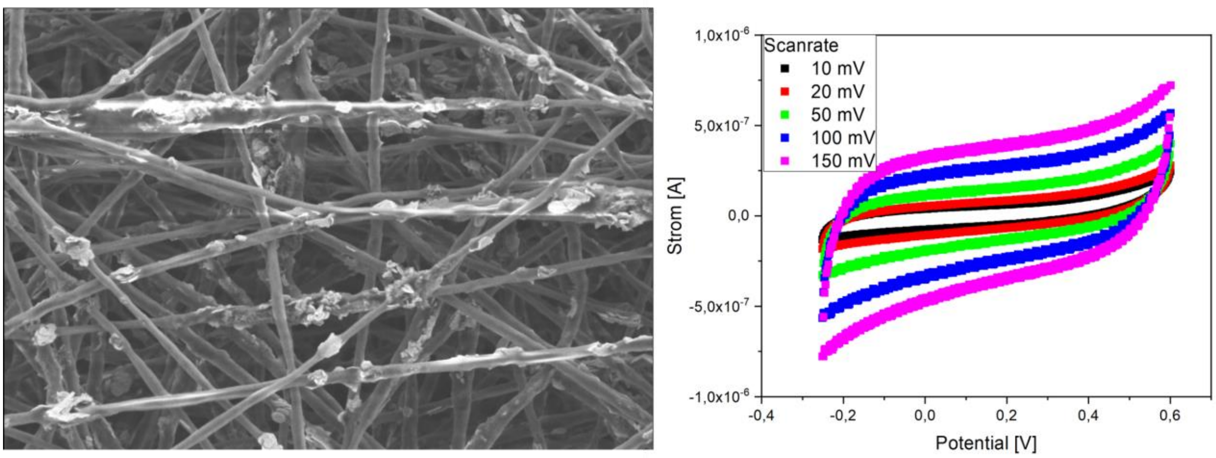

Figure 1: Bidimensional WS_2 in PEO fibres with added Carbon Nanotubes investigated with SEM and cyclic voltammetry at different scan rates.