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Liquid exfoliation of hydrothermally synthesized MoO_3 mesostructures in low toxicity solvents for the production of "green" 2D materials inks

Crisci Matteo, Paolo Dolcet, Peter Belteky, Akos Kukovecz, Francesco Lamberti, Silvia Gross, Teresa Gatti
Justus Liebig University, Heinrich Buff Ring 17, Giessen, Germany
matteo.crisci@phys.chemie.uni-giessen.de

α-MoO_3 is a promising material for use in charge extracting layers within optoelectronic devices, due to its wide gap and deep work-function, characteristics that makes it an established constituent of "hole transporting layers" in last generation solar cells and light emitting diodes. This material possesses a layered structure that makes it also suitable for mechanical exfoliation to produce 2D nano-sheets, allowing to further tune its electronic properties.[1]
Here, we will report on the synthesis of pristine bulk MoO_3 meso-structures and on their liquid phase exfoliation, that produces functional inks of few-layers 2D MoO_3. The first process is carried out employing a hydrothermal synthesis,[2] as a green and easily scalable method, while the second, makes use of both shear-mixing and tip sonication in different liquid media, so as to ascertain whether differences emerge in the resulting inks and 2D materials there contained. First characterizations, made through optical/Raman spectroscopy, dynamic light scattering and high-resolution transmission electron microscopy allows to frame the exfoliation process and identify the best conditions. In particular, we found good yields in exfoliated products employing water-based media. We then proceeded in further characterizing these materials through X-Rays Absorption (XAS) and other advanced optical and microscopy techniques to improve our understanding of their structural and functional properties for the future use in next generation optoelectronic devices.

References

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[2] P. Dalle Feste, M. Crisci, F. Barbon, F. Tajoli, M. Salerno, F. Drago, M. Prato, S. Gross, T. Gatti, F. Lamberti, *Appl. Sci.* **2021**, *11*, 2016.

Figures

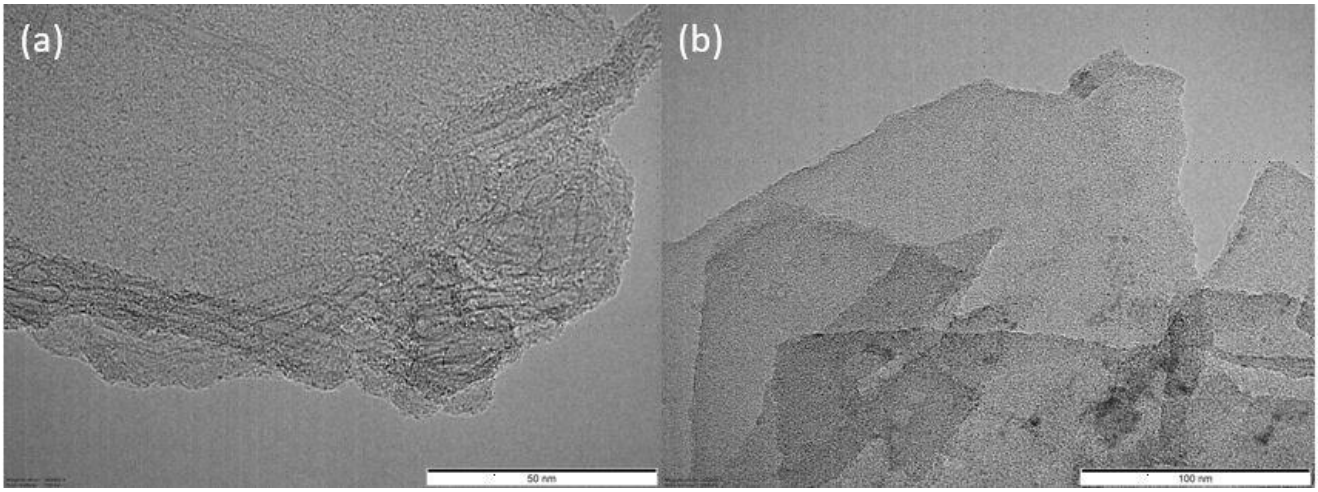

Figure 1: TEM images of (a) IPA/H_2O and (b) water exfoliated MoO_3