Graphene snowballs or snowflakes?

Graphite can be easily treated chemically to obtain graphene oxide, by analogy to graphene, the single-layer form of graphite. Graphene oxide (GO) forms nanoscopic two-dimensional sheets, commonly used in membranes and composite materials. Unfortunately, it is not easy to manipulate and create microscopic structures with it.
In this project, you will test a method for building up microscopic structures of GO by simply letting a droplet containing GO to evaporate under controlled conditions. For the project we will make use of superhydrophobic substrates, in which the droplet remains almost as if levitated [1]. As the droplet volume reduces, the GO particles assemble at the droplet surface in certain way that is unknown to us. GO self-assembled balls might look as in Figure 1 and like snowflakes, or the platelets might orientate differently and look like snowballs!.

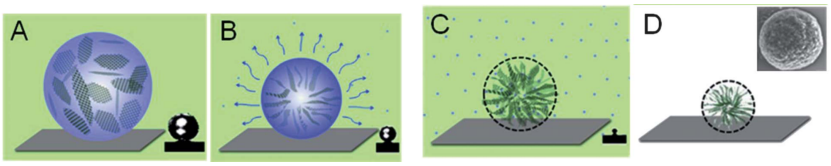

Figure 1: Formation process of a GO snowball/snowflake by solvent evaporation or dissolution. The current figure has been extracted from the work of H. Yang et al. [2]. (A) A droplet containing GO sheets is deposited on a superhydrophobic substrate and (B) left to evaporate (or dissolve, as in [2]). In (C) and (D), the GO sheets assemble such that the final object resembles kind of a snowflake (just much tinier).

Your job in this project will be to perform the evaporation experiments and film the process from a side view in order to characterize the evaporation process. The supply of GO will be provided by our collaborator Dr. Lorenzo Botto from TU Delft, and further characterization of the samples will be performed in the MESA+ facilities. This project can be adapted to both: a bachelor project or a master project. In the master project you would be studying the dependence of the structures on environmental conditions and changes in the solvents.

Supervision	**Contact**	**Role**
Alvaro Marin	a.marin@utwente.nl	(daily)Supervisor
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[1] Carola Seyfert, Erwin JW Berenschot, Niels R Tas, Arturo Susarrey-Arce, and Alvaro Marin. Evaporation-driven colloidal cluster assembly using droplets on superhydrophobic fractal-like structures. *Soft matter*, 17(3):506–515, 2021.

[2] Haijun Yang, Yufei Wang, Yuting Song, Ling Qiu, Suojiang Zhang, Dan Li, and Xuehua Zhang. Assembling of graphene oxide in an isolated dissolving droplet. *Soft Matter*, 8(44):11249–11254, 2012.