Understanding the Size Selection of 2D Nanomaterials during Centrifugation

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Liquid phase exfoliation has proved effective at producing a variety of functional inks and fluids by forming stable dispersions of 2D materials. [1] However, many of the most remarkable properties of such 2D materials are defined by their size and aspect ratio. Controlling the distribution of such properties within a liquid exfoliated sample is therefore essential to realise their applications. One easily scalable approach for the size and shape selection of nanomaterials is centrifugation; [2] using the different hydration environment from surfactant encapsulated nanosheets to differentiate sizes and thickness. Previous works have used Stokes diffusion of disks and spheroids to model this mobility, [3] however experimental results using angled rotors has hindered confirmation due to the accelerated sedimentation when particles are pulled against the sides of angled centrifuge tubes, the so-called Boycott effect. [4] Here we used zone centrifugation in a density gradient parallel with the centrifugal field and a polydisperse sample of graphene flakes. Comparing the sedimentation rate with the ensemble flake size extracted from different fractions down the centrifuge tube provides a model for the diffusion properties of 2D nanomaterials in liquid dispersion.

References

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[3] S. P. Ogilvie, M. J. Large, M. A. O'Mara, P. J. Lynch, C. L. Lee, A. A. K. King, C. Backes and A. B. Dalton, *2D Materials*, 2019, **6**, 031002.
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Figures

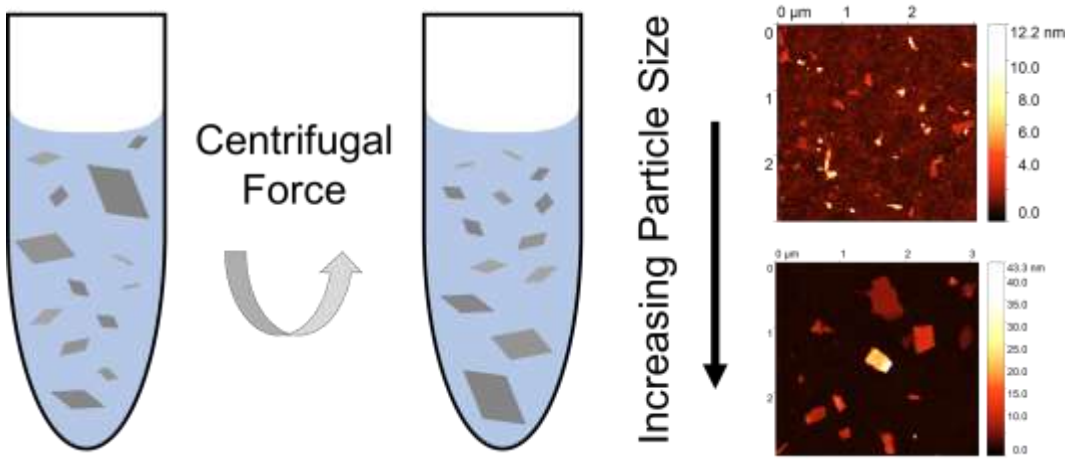

Figure 1: Insert caption to place caption below figure