

High-Throughput Mechanical Exfoliation for Low-Cost Production of van der Waals Nanosheets

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We present a method for scaling up the production of few-layer flakes of 2D materials via mechanical exfoliation.[1] Using a roll-to-roll setup and an automatized, massive parallel exfoliation process, adhesive tapes with a high density of few-layer van der Waals materials are produced. The technique allows for obtaining a good trade-off between large lateral size and excellent area scalability, while also maintaining low cost. The potential of the method is demonstrated through the successful fabrication of field effect transistors and flexible photodetectors in large batches. This low cost method to produce large area films out of mechanically exfoliated flakes is very general and it can be applied to a variety of substrates and van der Waals materials and, moreover, it can be used to combine different van der Waals materials on top of each other. Therefore, we believe that this production method opens an interesting avenue for fabrication of low-cost devices while maintaining a good scalability and performance.

References

[1] Y. Sozen, J. J. Riquelme, Y. Xie, C. Munuera, A. Castellanos-Gomez, *Small Methods*, 7, 10 (2023) 2300326

Figures

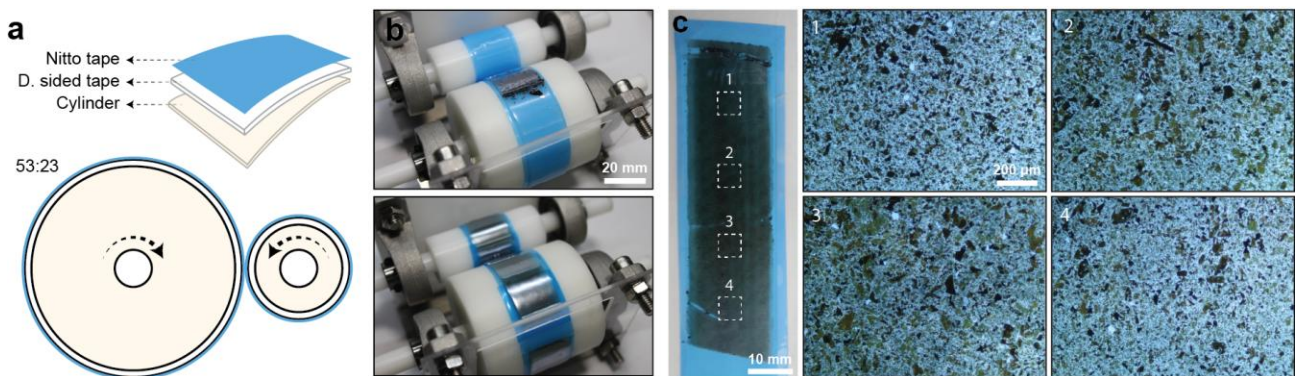


Figure 1: Massive parallel mechanical exfoliation of MoS₂. a) Sketch of the massive parallel mechanical exfoliation setup. Two polyoxymethylene (POM) cylinders are covered with double side tape. Nitto SPV 224 tape is attached to the double side tape with its adhesive pointing outside. b) Picture of the assembled setup with a macroscopic MoS₂ crystal exfoliated on the surface of one of the tapes before (top) and after (bottom) rolling the cylinders for 20 s. c) Optical image of the resulting tape after the exfoliation.