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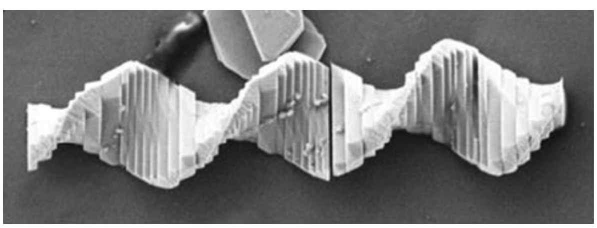
VAN DER WAALS MATERIALS

Growing twisted nanowires

The need to control the electronic and optical properties of 2D materials for practical applications has led to the development of complex structures such as van der Waals heterostructures. These are stacks that combine layers of different 2D materials, in which each layer is misoriented slightly relative to the layer below it. Along with the material composition, the twist angle plays a role in setting the heterostructure properties, providing an extra degree of freedom to tune electronic behaviour, such as superconductivity. van der Waals heterostructures are usually grown by the transfer-stacking method, which consists of mechanically assembling pre-grown layers. However, it only works for a limited range of materials and gives limited control over the twist.



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Writing independently in *Nature*, two groups — Peter Sutter and colleagues and Yin Liu and co-workers — demonstrated an alternative approach to synthesize complex van der Waals materials. Taking germanium sulphide — a layered monochalcogenide used in semiconductor and optoelectronic applications — both teams used a low-temperature vapour–liquid–solid method to create nanowires growing along the stacking direction. Unlike transfer stacking, the new approach is a catalyzed crystal growth method. It enables a particular growth mode — the Eshelby twist — that originates from an axial screw dislocation at the centre of a nanowire. It is therefore possible to grow spiral nanowires (pictured) almost three times thinner than the thinnest human hair and to finely tune their twist.

Both teams showed that the twist rate of the structure could be controlled by varying the nanowire thickness. In addition to that, Liu et al. also synthesized germanium selenide, thereby demonstrating that the growth mode is generic and this approach could be used to create similar twisted structures of other van der Waals materials.

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ORIGINAL ARTICLES Sutter, P., Wimer, S. & Sutter, E. Chiral twisted van der Waals nanowires. *Nature* **569**, 1–4 (2019) | Liu, Y. et al. Helical van der Waals crystals with discretized Eshelby twist. *Nature* **570**, 358–362 (2019)