Physical vapour deposition of atomically-thin crystals of the helimagentic material $NiBr_2$

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Since the discovery of graphene, two-dimensional (2D) materials with atomic thickness have rapidly grown to be a prosperous field in physical and materials science with interdisciplinary interest for their fascinating properties and wide applications [1]. There are a plethora of theoretical studies predicting magnetic monolayer materials, but only a few intrinsic ferromagnetic 2D materials were experimentally realized. The most explored family of magnetic 2D materials are trivalent halides of the type MX_3 (M = metal, X = halogen). Bulk divalent halides (MX_2) are also known to be magnetic. However, despite the presence of stable layered structures in the bulk, they still have not been studied thoroughly in the limit of a single layer, a fact which calls for more attention in near future [2,3]. Vapour-deposition grown transition metal halides will open the door for better quality and higher yield of few-layer crystals, and will continue to provide a fruitful playground for further exploring [4].

An interesting candidate that belongs to this family and was predicted to possess intrinsic ferromagnetism down to the 2D limit is $NiBr_2$. A unique combination of integrated geometry, dynamical stability, intrinsic ferromagnetism, a magnetic semiconductor and tunable magnetism makes $NiBr_2$ a promising candidate for next-generation electronic devices [5].

In the present study, atomically–thin 2D $NiBr_2$ crystals are grown by the physical vapour deposition technique. We report on a systematic study of the effects of growth parameters, such as pressure, temperature, time and substrates on the lateral size, thickness, orientation, and quality of crystal.

References

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