Microscopic study of free-standing liquid-exfoliated antiferromagnetic topological insulator $MnBi_2Te_4$

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A remarkable breakthrough in the field of a magnetic topological quantum system is the successful growth of $MnBi_2Te_4$ with its coexistence of magnetism and nontrivial bulk band topology. It paved an ideal pathway for studying the interplay between nontrivial band topology and long-range magnetic ordering, leading to intriguing quantum states like the Quantum anomalous Hall effect, axion insulators, etc. [1,2]. Now, any 2D material must extract a mono-layer/few-layer counterpart from its 3D bulk materials for potential applications. Here, liquid-phase exfoliation through ultrasonication is an inexpensive, environmentally friendly approach.
Now, the single-crystal $MnBi_2Te_4$ was prepared via a self-flux method. The scanning electron microscope (SEM) image in Figure.1.(c) and Figure.1.(d) showed that as-synthesized bulk $MnBi_2Te_4$ exhibits a sheet-like layered structure. The $MnBi_2Te_4$ 2D layers dispersed in a liquid solvent were characterized by transmission electron microscope (TEM). Here, we observed the existence of periodic local structures.

Figures

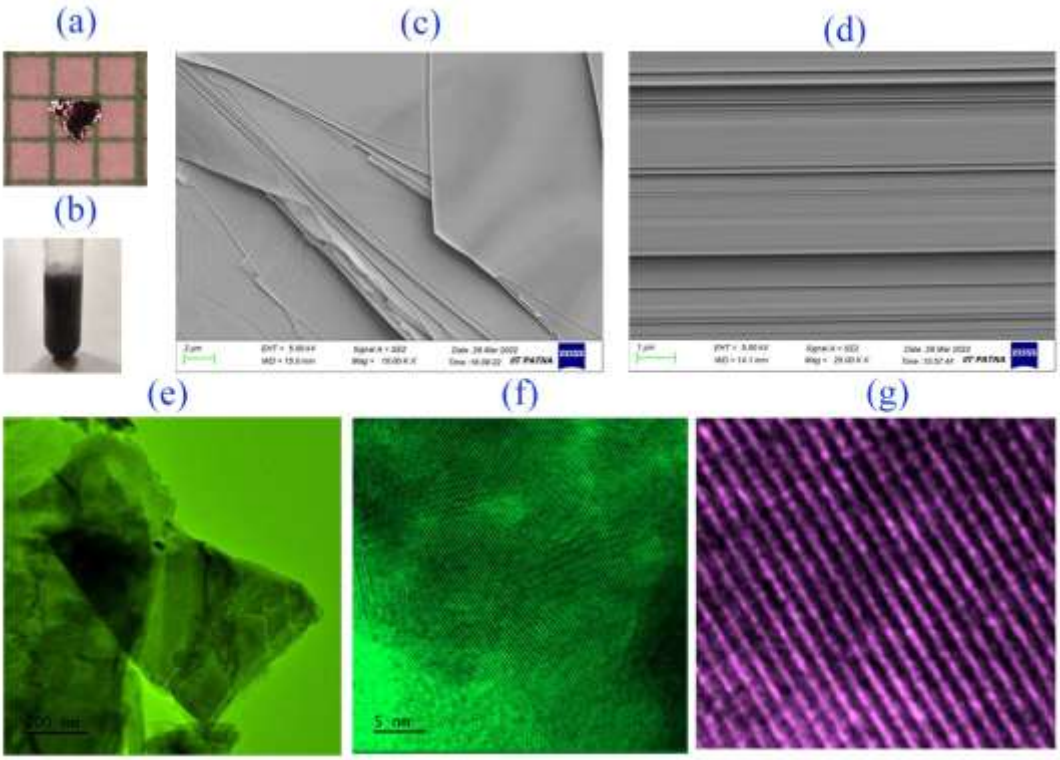

Figure 1: (a)The topography image of a flake of $MnBi_2Te_4$ crystal. (c) TEM image of $MnBi_2Te_4$ sheet (f) & (g) HR-TEM images of a 2D layer of $MnBi_2Te_4$ sheet obtained through ultrasonicated liquid-phase exfoliation.

References

[1] Zhao , Yi-Fan *et. al.*Nano Letters, 21(18) (2021), 7691–7698.
[2] Liu, C., Wang, Y., Li, H. *et al.* Nat. Mater. 19, (2020), 522–527
[3] Coleman, J. N., Accounts of Chemical Research, 46(1) (2012), 14–22.