Electrochemical delamination of a magnetic topological insulator

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Abstract

MAGNETIC topological insulators are intensively investigated for their potential application in quantum computing and spintronics. The currently most important material is $MnBi_2Te_4$ [1-3], a layered van der Waals compound that consists of magnetic septuple layers [Te-Bi-Te-Mn-Te-Bi-Te]. The surface of the material is of special interest, since the topological and also other physical effects manifest there or originate from it [1-4]. Up to now, all investigations were performed on mechanically exfoliated material. We now developed an up-scalable electrochemical method for liquid-phase exfoliation from which free-standing thin flakes with large aspect ratio are obtained. Even more interesting is the unexpected formation of $MnBi_2Te_4$ nanoscrolls, which is an unprecedented morphology for (magnetic) topological insulators. High resolution transmission electron microscopy revealed that the rolled-up flake is two septuple layers thick. The lengths can exceed 50 microns while the diameter varies with the applied voltage. By slow centrifugation, discarding the sediment, the ratio of nanoscrolls towards platelets in dispersion can be increased to more than 95 %.

References

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Figures

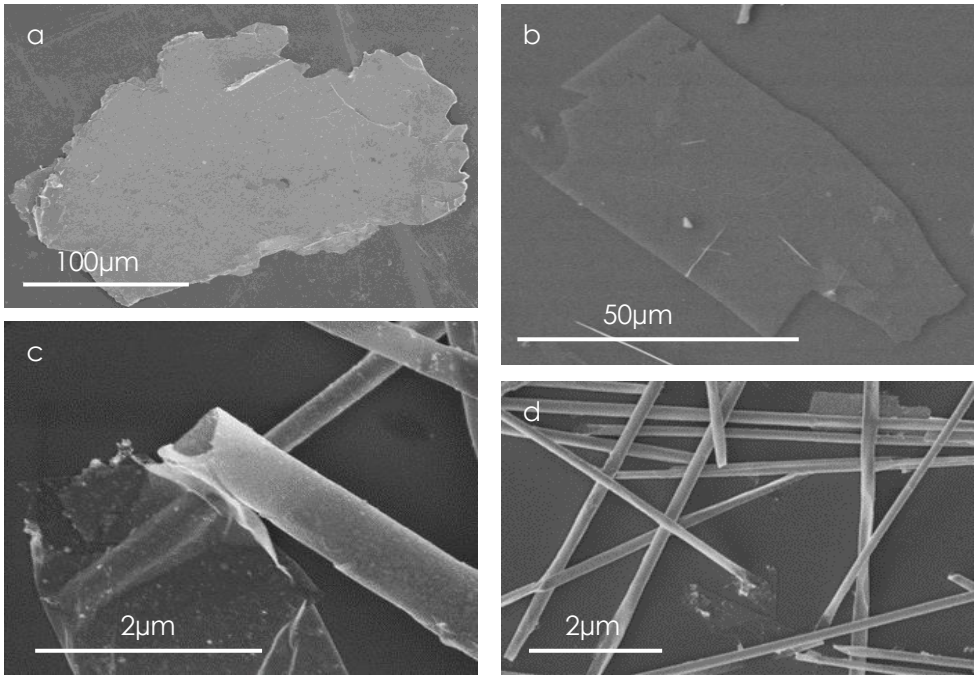

Figure 1: SEM images of exfoliated flakes (a,b) and nanoscrolls (c,d) formed by electrochemical exfoliation of $MnBi_2Te_4$.