2D Antimony Oxide by Deintercalation of $K_2(Sb_2O_3)_2Te$

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Perspectives and research on free-standing 2D materials, especially functional materials, promises new chemical and physical properties but also comes with challenges regarding the control of dimensions, minimization of defects, handling, mechanical and chemical damage prevention and many more factors. Utilizing hydroflux synthesizes [1-2] in an equimolar mixture of KOH and water in an autoclave, shiny green platelet crystals of the layered material $K_2(Sb_2O_3)_2Te$ were synthesized. Similar to Sb_2O_3, but unlike K_2Te, the compound is insensitive to air and water. By using ion extraction techniques in presence of crown-ethers under mild conditions, both potassium and tellurium ions can be deintercalated. The crystal morphology does not change significantly, but the platelets are now silvery and mica-like. The composition is Sb_2O_3, but the 3D crystallinity has been lost. We assume that the ferroelectric Sb_2O_3 layers of the initial compound have been preserved and form a metastable polymorph. Since the dipoles of adjacent layers are opposite, it is a repulsive van-der-Waals stack that is prone to delamination.

References

[1] W. M. Chance, D. E. Bugaris, A. S. Sefat, H.-C. zur Loye, Inorg. Chem. **2013**, 52, 11723–11733.
[2] R. Albrecht, M. Ruck, Angew. Chem. Int. Ed. **2021**, 60, 22570–22577

Figures

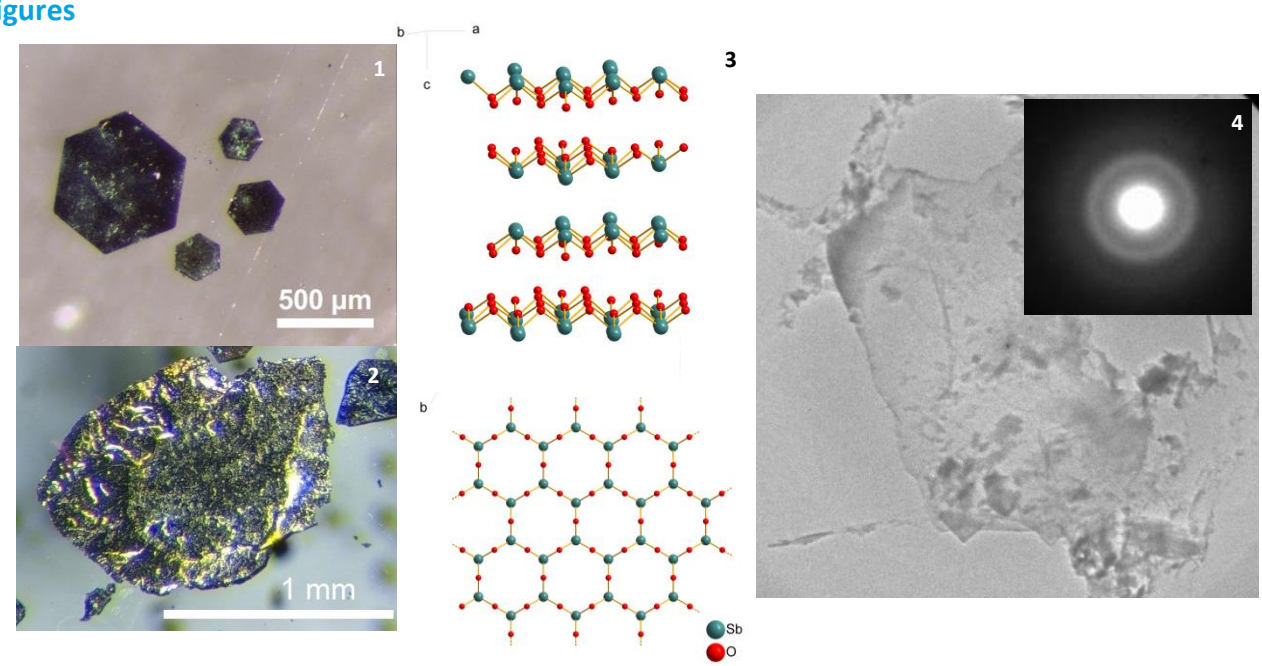

Figure 1: Cystals of $K_2(Sb_2O_3)_2Te$ (1) and layered Sb_2O_3 (2). Sb_2O_3 partial structure in $K_2(Sb_2O_3)_2Te$ (3) and TEM image of exfoliated flakes of metastable Sb_2O_3 (4).