Bulk synthesis of misfit layer compounds in the ternary systems V-Se-Bi and V-Se-Sn

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Transition metal dichalcogenides (TMDs) are of interest in numerous applications due to their interesting physical properties. Especially, in thin films they are superior to graphene, due to their ability to be functionalised. Incorporation of that thin film properties in the bulk is challenging. One method is the creation of metastable fereocrystals or stable misfit layer compounds (MLCs), which both are composed of an alternating stack of thin TMD layers and chalcogenide-pnictide layers, according to this formula [(MX)_{1+δ}]_m(TX_2)_n.

The volatility of the source materials is a major challenge for bulk synthesis of MLCs. Different methods of synthesis were utilised in order to yield the desired compounds. A classical approach by CVD with iodine as transporting agent and the KCl-LiCl flux synthesis, which was only used once before in that kind of context [1], were employed. Furthermore, we were investigating the impact of a microwave synthesis method on the formation of that compounds.

In our recent study were able to synthesise several MLCs in the ternary systems V-Se-Bi as well as V-Se-Sn. Compared to earlier approaches by PVD synthesis [2, 3], we can report on the discovered solubility ranges and former unknown equilibrium compositions in both systems.


[3]. Falmbigl, M., Hay, Z., Ditto, J., Mitchson, G., and Johnson, D.C., Modifying a charge density wave transition by modulation doping: fereocrystalline compounds ([Sn_{1-x}Bi_{x}Se]_{1.15})_{1}(VSe_{2})_{1} with 0 <= x <= 0.66. Journal of Materials Chemistry C, 2015. 3(47): p. 12308-12315.