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Deposition of WTe_2 nanolayers on substrates by direct CVT

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Due to its promising properties like high pressure super conductivity[1], a giant non-saturating magnetoresistive effect[2] or the probable existence of Type-II-Weyl-Fermions [3], WTe_2 and its mono- and few-layer structures are widely researched. To further research these properties highly crystalline layers are needed. Methods used today (e.g. exfoliation) lead to either very small sample sizes with lots of defects or they are not very reproducible. By depositing such WTe_2 structures directly on the chosen substrate via CVT we gain an easier access to highly crystalline structures with a high amount of reproducibility. To allow for rational planning of the synthesis, simulations where performed using TRAGMIN and CVTRANS after gathering the needed thermodynamic data by calculations. The elements and TeX_4 (X = Cl, Br) were sealed and treated in a 2-zone-furnace to allow for the transport directly on YSZ substrates. Transported bulk samples as well as thin layers where examined by SEM, EDX, powder- and single crystal XRD, XPS and AFM to show the successful deposition of thin layers on the substrate as well as to show the high quality of the produced structures.

References

[1] D. Kang *et al.*, *Nat. Commun.* 6 (2015), pp. 6–11.
[2] M. N. Ali *et al., Nature,* vol. 514, no. 7521 (2014) pp. 205–208.
[3] A. A. Soluyanov *et al.*, *Nature*, vol. 527, no. 7579 (2015) pp. 495–498.

Figures

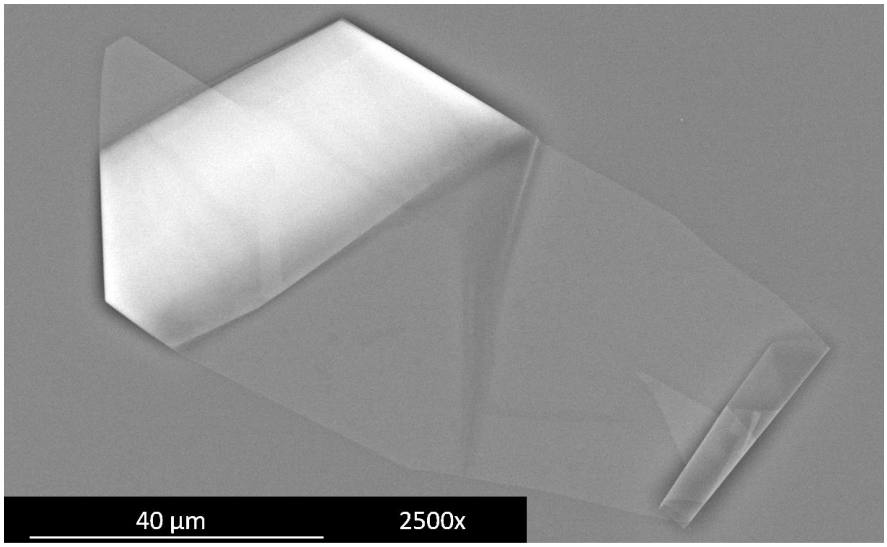

Figure 1: SEM picture of a thin layer of WTe_2 as synthesized on a YSZ (111) substrate by CVT