Extension of rapid estimation of the flake thickness by color for a magnetic van der Waals 2D material

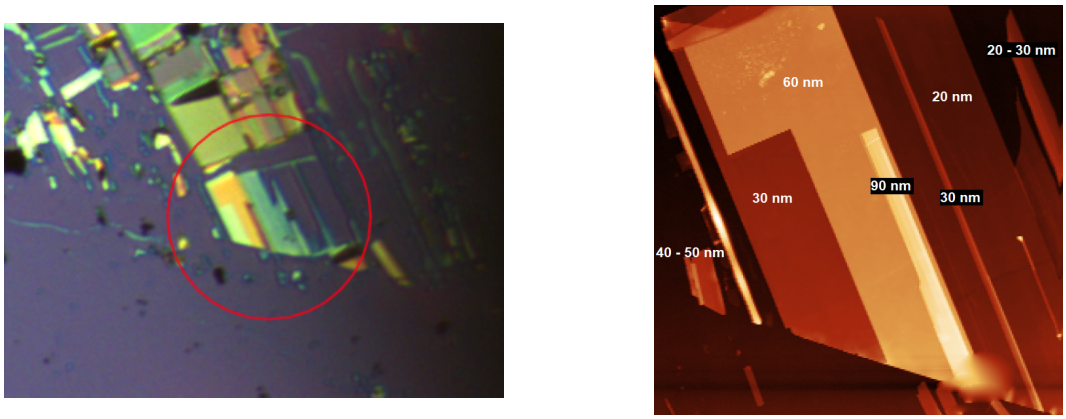
R. Komar, M. Raczyński, T. Kazimierczuk and P. Kossacki

Institute of Experimental Physics, Faculty of Physics, University of Warsaw, Pasteura 5, PL-02-093 Warsaw, Poland

The color analysis of thin flakes exfoliated on Si/SiO_2 substrates is an efficient method for identification of flakes of a given thickness. It is well known since the beginning of studies on graphene and related thin materials (especially hexagonal boron nitride[1]). With this method, we can bypass the need of using atomic force microscopy (AFM) to measure the thickness, significantly increasing the speed of the assembly of more complex structures. Thus, we greatly reduce the exposure time of the sample to potentially degrading external agents, which would be especially beneficial for rapidly oxidizing materials, one of which is chromium sulfide bromide (CrSBr).

CrSBr is an example of a layered van der Waals material that combines both optical and magnetic properties. Such a combination usually requires stacking of two different materials, while here it is realized within a single flake. The coupling of magnetic and optical properties makes this material a potential system for spintronics applications. Additionally, the magnetic properties of these materials vary with the number of atomic layers, which can help tailor them for technological applications.

Have we extended the well known methods of fast optical estimation of the layer thickness on the group of magnetic materials. By careful comparison of optical color images and AFM scans, we calibrate this technique for such materials as CrSBr. An example of a flake snapshot from the optical microscope and AFM scan with thickness readings for CrSBr is shown in Fig. 1. Importantly, most of the steps within this procedure can be done in a glovebox within a very high purity inert atmosphere, reducing the chance of material degradation.



a) b)

Figure 1: Snapshot and AFM scan (with thickness labels) of CrSBr flake.

The obtained data allowed us to map the range of the thicknesses corresponding to selected colors. We discuss also enhancement of the sensitivity possible with use of narrow color filters.

[1] Yuto Anzai, et al, 2019, *Appl. Phys. Express* **12** 055007