Contribution ID: **19** Type: **Poster**

Interlayer correlations in 1:1 ferecrystals

Tuesday, 18 September 2018 17:15 (15 minutes)

Understanding and controlling nucleation and growth is an important step in improving the crystallinity of thin films and thus crucial for the materials performance.[1] Nanolaminates represent ideal model systems to study interfacial nucleation, because they offer precise control on a sub-Å length scale. Ferecrystals are nanolaminate compounds with the general formula $[(MX)_{1+}]_m[TX_2]_n$ (M = Pb, Sn, Bi, or rare earth metal; X = S, Se, Te; T = transition metal, δ the misfit parameter).[2] The individual ferecrystal components are precisely oriented in the stacking direction but generally rotationally disordered in plane[2] and can thus be regarded as individual nanostructures.[3]
In contrast, recently studied m = n = 1 ferecrystals indicate directionally dependent interlayer registration.[4] Here we present a systematic study of such interlayer structural correlations. Unexpected reflections are identified by reciprocal space mapping that indicate interlayer correlations between the binary compounds, appearing stronger with improved lateral lattice match. Our results provide important insight into the formation mechanism of ferecrystals, suggesting preferential nucleation and layer alignment during self-organization.
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Presenter: HENTSCHEL, Maria

Session Classification: Poster session 2

Track Classification: P5 Thin films, 2D materials and surfaces