



Figure 1: Growth characteristics and material properties of  $\text{Nb}_x\text{W}_{1-x}\text{S}_2$  alloys grown by PEALD. a) the thickness evolution of pure  $\text{NbS}_2$  and  $\text{WS}_2$  and two alloys as measured by in-situ spectroscopic ellipsometry. b) the composition of the alloys as a function of the ALD cycle fraction follows the ideal rule of mixtures, while the stoichiometry varies from overstoichiometric for W-rich films to understoichiometric for Nb-rich films. c) the morphology changes significantly with alloy composition: the highest density of out-of-plane oriented crystallites is observed for  $\text{NbS}_2$ : $\text{WS}_2$  cycle ratio 1:3 ( $x=0.54$ ). d) raman spectroscopy shows an evolution from polycrystalline  $\text{WS}_2$  to mostly amorphous  $\text{NbS}_2$ . e) comparing cross-sectional HAADF-STEM micrographs of the standard  $(\text{AC})_m(\text{BC})_n$  supercycle process to the modified  $(\text{AC})_m(\text{ABC})_n$  process shows the latter results in significantly lower density of out-of-plane oriented crystallites, which is accompanied by an improvement in the electronic properties of the film as demonstrated by the Hall measurements shown in f).