Polycrystalline Ni–Mn–Sn Heusler alloys show a large exchange bias field below a blocking temperature $T_B$ [1-3], making them promising candidates for future spin valve and magnetic recording devices. Here, we use small-angle neutron scattering (SANS) [4] to directly image the magnetization process in Mn$_{50}$Ni$_{40-x}$Sn$_{10+x}$ in the reciprocal space. At zero field and low temperatures, we are able to observe the coexistence of ferromagnetic domains ($>100$ nm) and local clusters ($\sim 10$ nm). In the field-induced magnetization process below $T_B$, the ferromagnetic domains and domain / cluster interfaces exhibit a large susceptibility at the exchange bias field, as revealed by the Porod fitting to the scattering data, while the local clusters remain relatively resilient. These results agree with the theory where exchange bias results from the ferromagnetic unidirectional anisotropy formed at the interfaces between different magnetic phases [5].

References: