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Ordering mechanism in NiMn-based Heusler alloys

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The characteristic length scale of the L21 anti-phase domain (APD) structure has been observed to have a significant influence on the magnetic properties of Ni2Mn-based Heusler alloys. Specifically, a small scale APD structure leads to a decrease in ferromagnetic properties. Up to this point, the fundamental mechanism of this relation is not understood. Yet, it is conjectured that either chemical segregation effects at the APD boundary or a magnetic coupling across the boundary play an important role in the observed property degradation. The ideal systems to study this phenomenon are the full-Heusler compounds Ni2MnAl0.5Ga0.5 and Ni2MnAl where the phase transition temperatures and diffusion kinetics allow to adjust a variety of APD dimensions. In the scope of this proposal, we intend to perform small angle neutron scattering experiments on samples from both alloy systems with a range of APD sizes. By recording diffraction patterns at a variety of temperatures in the paramagnetic and ferromagnetic regime, we intend to reveal and distinguish potential segregation and magnetic coupling effects at the APD boundary.

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