# Atomic and Magnetic Force Microscopy for studying magnetic Heusler compounds

Francesca Casoli[1], Milad Takhsha Ghahfarokhi, Lucia Nasi, Giovanna Trevisi, Franca Albertini
[1]IMEM - CNR, Parma, 43124, Italy

Heusler compounds are a huge class of ternary intermetallics, including full Heusler $X_2YZ$ and half Heusler XYZ, in which X and Y represent transition or rare-earth metals, and Z represents the main-group element. Ferromagnetic shape memory Heuslers are a subclass that shows multifunctional properties arising from a strong coupling between magnetic, thermal, and mechanical degrees of freedom. $Ni_2MnGa$ is a model system within this subclass and shows a martensitic phase transformation from a cubic phase (austenite) to a lower symmetry phase (martensite) by decreasing temperature.

Atomic and Magnetic Force Microscopy (AFM, MFM) are powerful tools to investigate Ni-Mn-Ga thin films. We grow these films by sputtering on MgO(100) and Cr/MgO(100). The austenitic phase grows epitaxial at high temperature. In the martensitic phase, stable at room temperature, films show a complex twin microstructure, with characteristics that can be engineered by growth parameters and external stimuli (temperature, magnetic field, stress).[1] Each specific twin microstructure imposes a specific geometrical arrangement of the easy-magnetization axes, giving rise to a characteristic magnetisation pattern that can be visualized by MFM. AFM and MFM studies as a function of temperature and magnetic field will be shown.

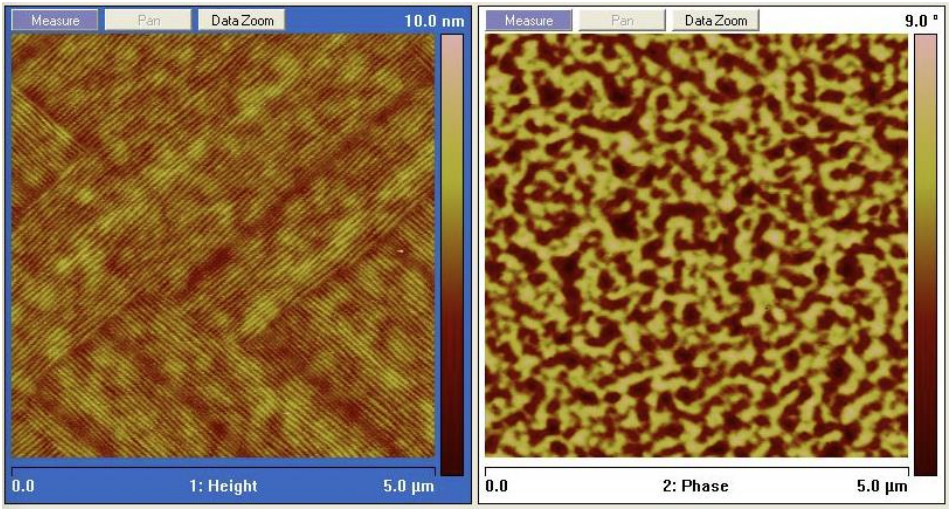


Fig. 1. Topography (left) and magnetic contrast (right) images collected on a 200 nm Ni-Mn-Ga thin film

References:

[1] Milad Takhsha Ghahfarokhi et al., Acta Materialia 187 (2020) 135145.