

Texture analysis of melt-spun Ni₂MnGa tapes by means of electron backscatter diffraction (EBSD)

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A texture analysis is performed by means of the electron-backscatter diffraction technique (EBSD) on melt-spun ribbon-like samples of the composition Ni_{52.5}Mn_{24.5}Ga₂₃ (at.-%). The EBSD analysis and transmission electron microscopy (TEM) revealed that the samples have a granular morphology, with grain sizes of the order of 1 – 2 µm. The as-spun ribbon showed dominant L2(1) austenitic (cubic) structure with a splitting of the primary peak in the X-ray diffractogram indicating the existence of a martensitic feature; the bigger martensitic grains are surrounded by many austenitic ones. For such samples exhibiting a complicated microstructure, a dedicated surface treatment is required in order to achieve high quality Kikuchi patterns.

In order to obtain undisturbed sample surfaces, mechanical polishing plus ion polishing (5 keV Ar ions, 1 min, small incident angle ~5°) was employed. The inset to Fig. 1 shows the high-quality Kikuchi patterns achieved with this method. This enables a detailed crystallographic analysis and also magnetic force microscopy (MFM) to be performed.

The EBSD analysis reveals that several larger grains are present in the selected region and many small grains are detected, even embedded within the larger ones. Figure 1 gives a detailed analysis of the grain size distribution (grey scale) and the EBSD-detected misorientation angles (colour scale), plotted as a map and in the respective diagrams. The small grains are randomly oriented,

but the larger grains exhibit a common direction of elongation, yielding a specific texture in (1 0 0)-direction. EBSD performed with higher resolution (stepsize ~ 20 nm) finally reveals also the martensitic features (twin structure) within some grains as observed in the TEM investigations.

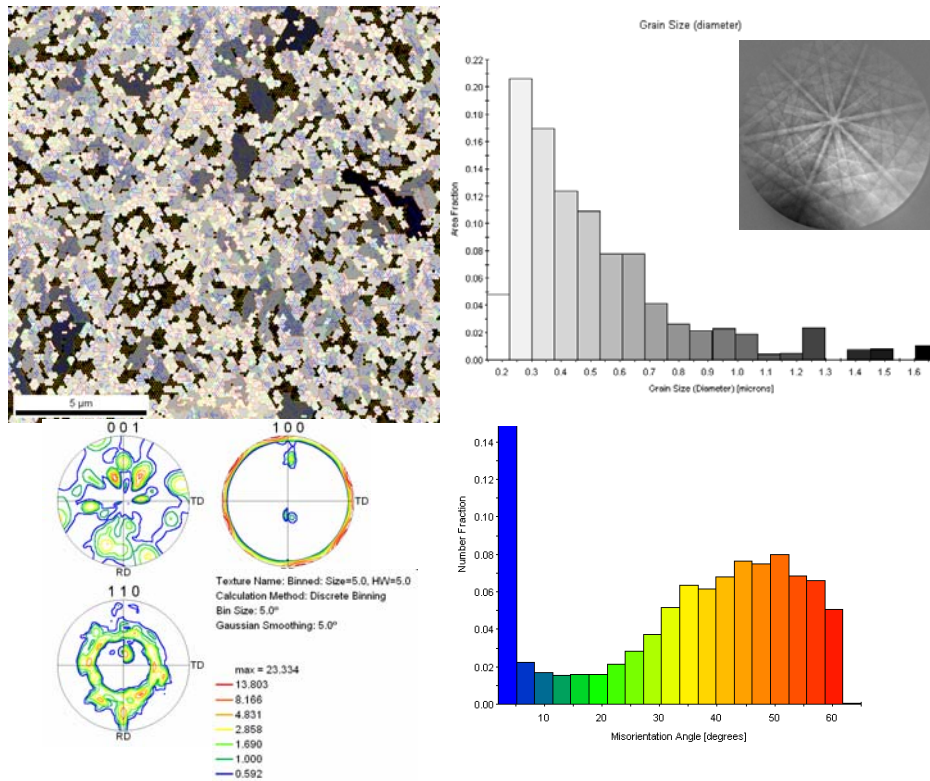


Fig. 1: EBSD analysis on Ni_2MnGa . Shown is a grain size map (grey scale), together with the detected misorientations (colour scale). A Kikuchi pattern of Ni_2MnGa is presented, and also the EBSD-determined pole figures.

The EBSD data are compared to MFM data obtained on identical samples, enabling an improved interpretation of the magnetic data. Altogether, the EBSD analysis is proven to be a useful tool for a detailed investigation of crystallographic orientations, especially for samples where two or more phases are present.