ESRF	**Experiment title:** The evolution from the seed crystal to the necking - and then a good Heusler single crystal?	**Experiment number:** HC-469
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Report:

The Heusler alloy Cu_2MnAl has a cubic high temperature structure $L2_1$ with interesting magnetic properties. This alloy is often referred to as a prototype system for a metallic ferromagnet with localized moments that are entirely localized at the Mn sites. In the case of neutron scattering the 111 reflection of Cu_2MnAl reveals the important property that the nuclear and the magnetic scattering lengths cancel to essentially zero structure factor for one spin state, whereas they add up to a large scattering length for the other spin state. This provides the basis that the 111 Bragg reflection on Cu_2MnAl single crystals is the most commonly applied method to produce a polarized neutron beam in the thermal energy range.

In neutron scattering a single crystal monochromator has typically a volume of 100 cm^3. This volume needs to be of homogeneous crystalline quality. It has to have a fine micro structure which provides a high reflectivity over an angular range of some 0.5° with little extinction. However, in the past the growth of Cu_2MnAl single crystals has given unsatisfactory results. The crystals generally show a strong tendency towards the formation of grain boundaries with tilt angles of several degrees. These grains are often elongated along the growth axis of the crystal.

In the present study we took advantage of the strong penetration power of high energy X-rays (-100 keV) available on ID15 to analyze the grain structure of several Cu_2MnAl ingots. The crystals were grown by a modified Bridgman-Stockberger technique with different growth rates and various forms for the crucible tips. Figure 1 shows examples of high resolution real space mappings for two crystals investigated.

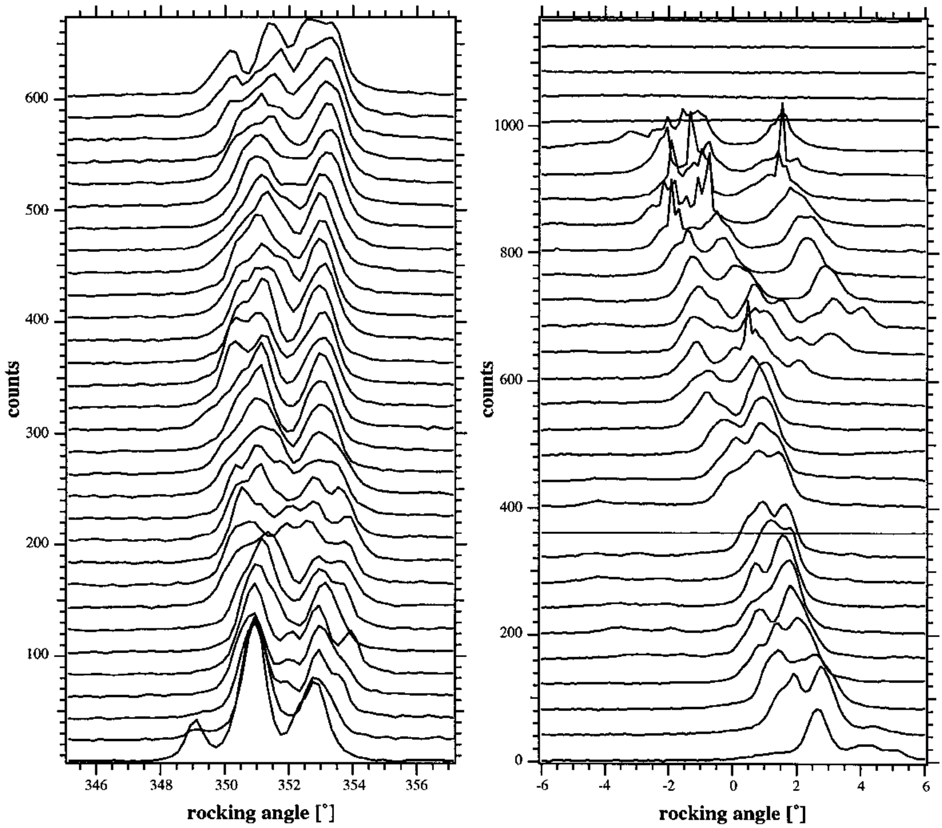

Figure 1: Real space mappings of the 220 reflection of Heusler crystals. The vertical offset is proportional to the translation of the crystal. The peak positions in the left panel remain quasi constant whereas in the right panel they change with the appearance of new peaks. The crystal shown in the left panel exhibits good coherence throughout the crystal volume.

The results as evaluated up to date already indicate that the crystal quality deteriorates towards the lateral surfaces of the ingots underlining the importance of a better controlled interface between the crucible wall and the single crystal. In addition we noticed that careful necking and polishing of the inner crucible wall may be options to reduce grain formation.