Diffraction experiments of decagonal Al-Co-Ni under high-pressure and low-temperature conditions, Kai H. Hassdenteufel,* Günter Krauss, Sergiy Katrych and Walter Steurer, *Laboratory of Crystallography, ETH Zurich, CH-8092 Zurich, Switzerland*. E-mail: kai.hassdenteufel@mat.ethz.ch

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Until today, the question of the mechanism that stabilizes the quasicrystal's structure is still not answered. Two main possibilities are discussed: entropy stabilization through local/global structural disorder *vs*. enthalpy stabilization (energetically preferred atomic arrangements, so-called clusters). To find hints about the answer to this question, diffraction experiments under non-ambient conditions are essential. Therefore many experiments were done, starting from different directions (e.g. high-energy ball milling, high-pressure experiments) aiming at the same topic: to induce a low-temperature phase transition of the quasicrystal. Further experiments aiming at this topic are in progress. On the one hand, powder X-ray diffraction measurements are performed, using a ball mill both at room temperature and under liquid nitrogen to induce a phase transition. The phase composition of the sample of the initial decagonal (d)-phase is detected in dependence of varying ball-milling times. This method was successfully used before for the quasiperiodic phase in the system Al-Cu-Co, where a phase transition from the icosahedral phase to a B2–phase was found [1]. In-situ low-temperature measurements are also planned, using an N_2-Cryostream between 90 K and 300 K, since a phase transition was detected for the d-phase at 150 K [2]. On the other hand, single-crystal diffraction experiments are performed at low temperature ($\geq$ 20 K) and/or high pressure ($\leq$ 10 GPa) using the ETH diamond anvil cell. The experiments include both *ex-situ* as well as *in-situ* single crystal measurements. Neither X-ray diffraction experiments at low temperature at 20 K nor at high-pressure at 11.5 GPa [3], both performed *in-situ*, did show a phase transition of the Edagawa-phase [4]. This either indicates a high stability of this quasicrystal or a very sluggish kinetics of the phase transition. If the latter is true, we want to overcome it by either high-energy ball milling or non-hydrostatic low-temperature compression.

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