ESRF	**Experiment title:** **Synchrotron X-ray diffraction study of phase transitions and phases in novel high-Nb containing gamma-TiAl based alloys**	**Experiment number**: MA - 77
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Phase transitions and atomic rearrangement processes in polycrystalline substances play an important role in our daily life and are most important for the tailoring of modern materials. Multiphase alloys, such as titanium aluminides, bear distinguished mechanical properties depending on their thermo-mechanical treatment history and thus their microstructure. Much fundamental and industry-related research is undertaken to find the best process parameters. While metallurgical investigations are often obtained off-situ, little is known about the kinetics of the phase transition and the occurring atomic rearrangements. The importance of 2-D X-ray diffraction patterns and their relation to microscopic features has been demonstrated earlier [1, 2]. Here we report on novel in-situ time resolved diffraction measurements which were taken at elevated temperatures. The transition from ordered α_2-Ti_3Al to disordered α-Ti(Al) and to γ-TiAl has been followed in real time on a temperature ramp. High-temperature phases, such as β-TiAl could be identified. Quantitative Rietveld analysis has been performed below the α-transus temperature at about 1300 °C. The results are rich in information and show consistent anomalies in the refined parameters.

The figure shows results for one of the samples in the α+γ phase field. There is undercooling of the nucleation of the γ-phase upon cooling. Quantitative phase analysis shows the behavior of the order-disorder transformation in α_2 as well as lattice parameter anomalies when diffusion starts to play a role. The details are being prepared for a publication.

References:

[1] K.-D. Liss, A. Bartels, A. Schreyer, H. Clemens, "High energy X-rays: A tool for advanced bulk investigations in materials science and physics", Textures and Microstructures, (2003). 35 (3/4): p. 219-252. doi:10.1080/07303300310001634952

[2] K.-D. Liss, A. Bartels, H. Clemens, S. Bystrzanowski, A. Stark, T. Buslaps, F.-P. Schimansky, R. Gerling, C. Scheu, A. Schreyer: "Recrystallization and phase transitions in a gamma-TiAl based alloy as observed by ex- and in-situ high-energy X-ray diffraction", Acta Materialia, (2006), 54 (14): p 3721-3735. doi:10.1016/j.actamat.2006.04.004

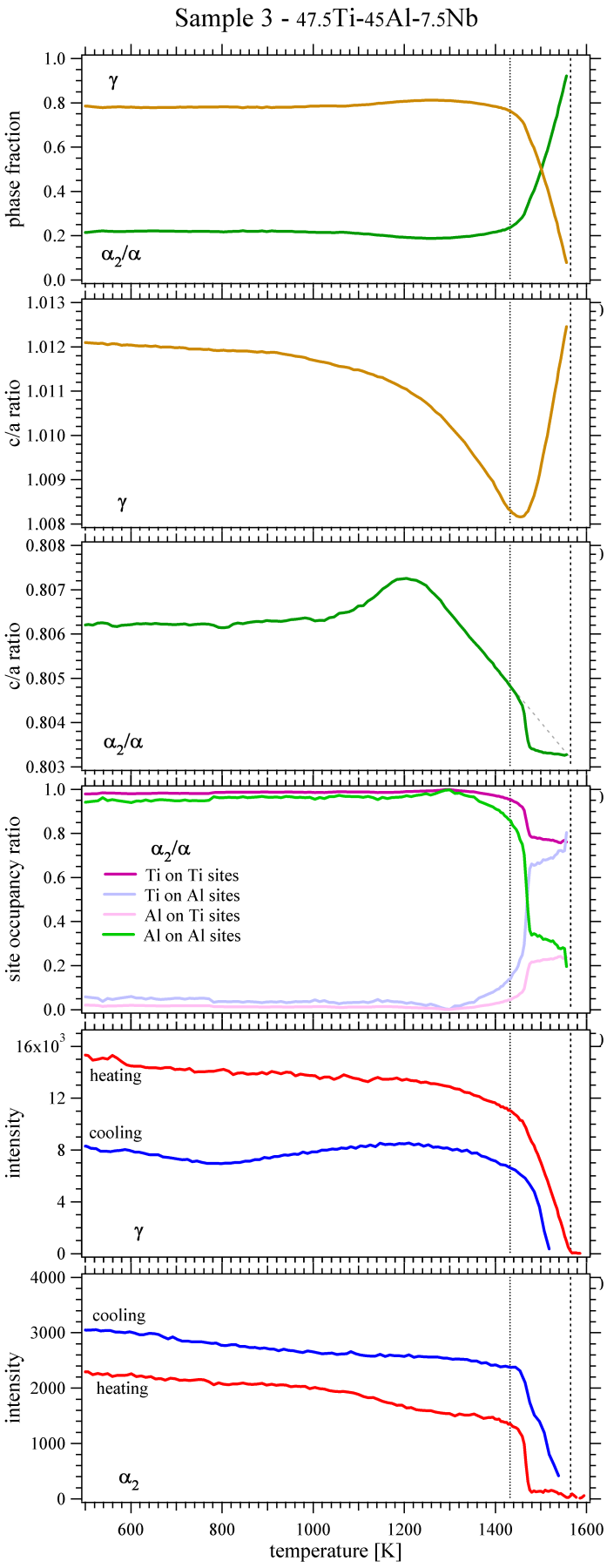

Figure 1: Intensities upon heating and cooling of selected reflections (bottom two) and Rietveld results (top four) of one of the investigated samples.