ROBL-CRG	**Experiment title:** **Time-resolved pursuit of martensitic phase transformation in Ti**	**Experiment number**: 20-02-40
Beamline: BM 20	**Date of experiment**: from: 17-nov-00 to: 21-nov-00	**Date of report**: 10-apr-01
Shifts: 12	**Local contact(s)**: Florian Berberich / Dr. Norbert Schell	*Received at ROBL:* 19. 4. 2001

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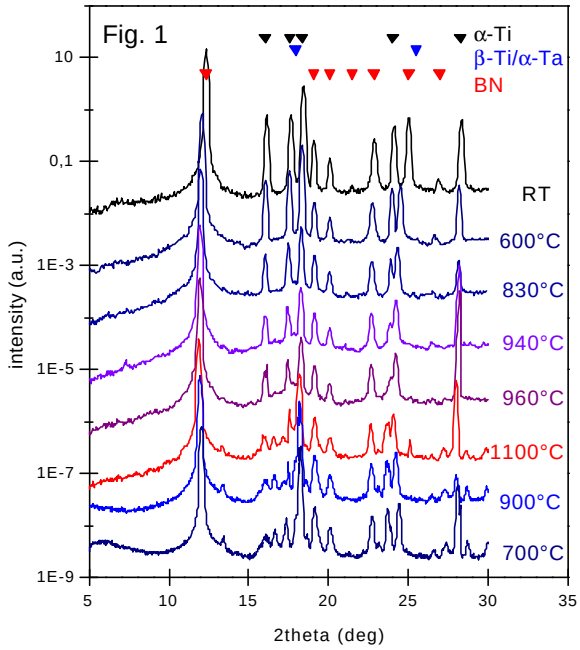
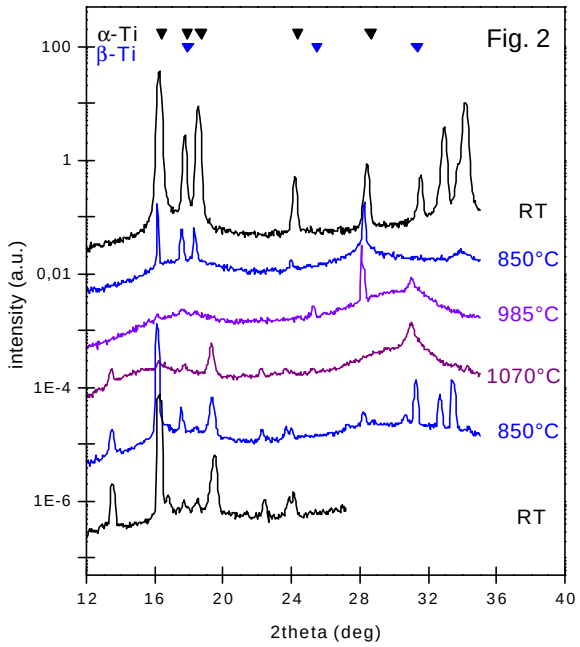
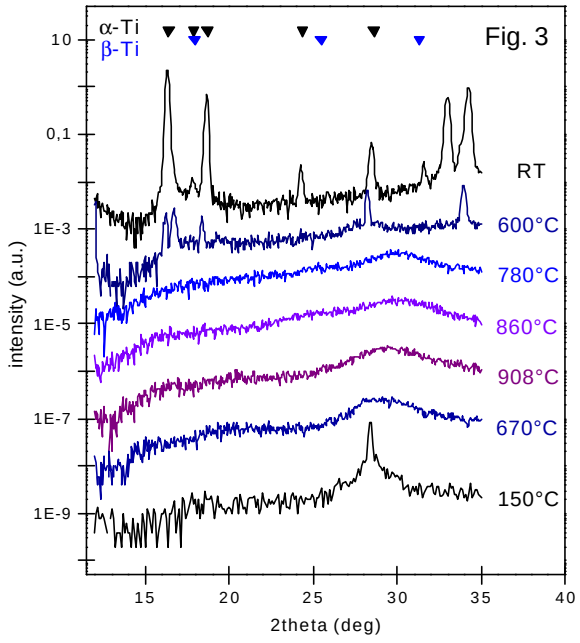
Report:

Martensitic phase transformations are of great interest since shape memory transitions with high technical applicability have to be assigned to this type of transformations. The aim of the experiment was to study the dynamics and the orientation memory effect of the transformation between the hexagonal low-temperature (LT) phase and the cubic high-temperatur (HT) phase of titanium as a function of time by means of monochromatic x-ray diffraction. By variing the temperature in an interval of 800°C to 1000°C ($T_{\alpha\leftrightarrow\beta}$ = 882°C) the decay of the LT-Bragg reflections and simultaneous growth of those of the HT phase should be observed. The titanium α to β transition was chosen because theory expilicitly refers to this material as a model case for bcc-hcp transition.
Usually experiments at elivated temperatures are demanding due to the high temperature differences between heater, sample and sample holder leading to systematic deviations of the measured values from the exact sample temperature. Due to geometric restrictions we used powder diffraction to calibrate the temperature scale. Figure 1 shows the curves of a BN/α-Ti pill mounted in the standard ROBL HTC as a function of the temperature of the sample holder. The peak positions of the α phase correspond to the PDF values but no significant intensity decrease, i.e. clear transition temperature is observable. In order to eliminate the influence of the boron nitride the experiment was repeated with a α-Ti







polycrystal of high purity. The results are shown in figure 2. Here a decrease of the LT phase peak intensities is evident. But even far above $T_{\alpha\leftrightarrow\beta}$ only weak indication of the cubic phase can be found by the broad diffuse scattering and a small instable peak at $\theta_B \approx 25°$. An explanation for the different intensity distribution before and after the heating could be a strongly developed texture of the polycrystaline material. A 2D CCD image of the sample confirms this assumption. In order to exclude the disturbance by the Ta-environment heater of the commercial chamber (a metal precipitate was found on the sample) a HTC from the university of Vienna was utilized, which had been calibrated pyrometric via the power consumption. The curves recorded at a comparable sample (figure 3) display only diffuse scattering intensity above the transition temperature. The experiment was planned as a feasibility test. It will be of considerable value for our further studies because we have learned that a sucessful investigation of the dynamic of phase transformations needs a more sophi-sticated experimental environment and sample preparation than the utilized one. Accordingly a small HTC has been desig-ned with a Be-hemisphere wich will allow for experiments under UHV without geo-metrical restrictions. The vacuum condi-tions reached in this experiment ($\approx 10^{-6}$ mbar) are a possible reason for the incomplete transformation since titanium especially at elevated temperatures is known as a getter material.