Experiment Report on Beamtime HC-4354

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1) Short description of the actual experiment (including user provided setups) and typical example of the results obtained.

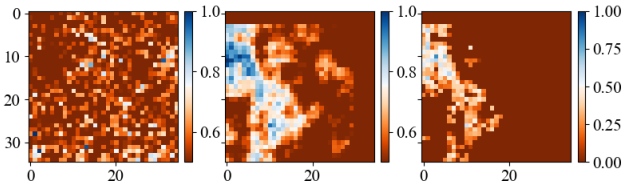

Figure 1: Transient x-y-map of the intensity of a monoclinic reflex at a pump-probe delay of 15 ns after the laser excitation (left). The middle and right image depicts the original superdomain distribution and the transient difference, respectively.

In the experiment we measured the dynamics of the monoclinic to orthorhombic phase transition in Ka0.7Na0.3NbO3 (KNN). Specifically, we measured reciprocal space maps (RSMs) at the [620] Bragg reflex The low-T phase displays four reflexes that stem from superdomain formation in the monoclinic phase at Q_y≠0. These reflexes disappear in the high-temperature phase, thus indicating the phase transition. For fast heating on nanosecond timescales, we installed an Ekspla NL202 Q-switched laser which was synchronized to the bunchmarker signal provided by the beamline. The sample was excited with optical pulses with a wavelength of 1064 nm, pulse duration of 7 ns and a repetition rate of 1 kHz. We monitored the dynamics of the phase transition at various base temperatures via the intensity of the monoclinic Bragg peaks. After successful alignment, we measured RSMs in imaging mode with a spatial resolution of 200 nm and a step size of 500 nm. For comparison, the size of ferroelectric domains and superdomains is 50 nm and few µm, respectively. The ordering of the ferroelectric domains is well understood and can be retrieved from RSMs. The formation of superdomains on µm length scales was monitored in this experiment. Preliminary data is shown in Figure 1.

2) If applicable: short description of any difficulties encountered during the experiment (beyond the information addressed in your beamtime feedback)

Installation and synchronization of the laser setup worked out of the box, thanks to the excellent preparation of the beamline by the supporting scientists. We encountered some problems during measurement of the time-resolved spatial maps. These measurements required a different handling of the communication with the detectors compared to the static measurements that are usually performed at the beamline. We want to thank all beamline scientists and engineers for their dedicated work in handling these issues.

3) Has the aim of the experiment been achieved? Are the data sufficient for publication? If not: which data/information would be needed in addition to the obtained results?

The main goal of the experiment was the measurement of spatiotemporal mapping of the phase transition. The experiment was successful and we could obtain data that is currently being evaluated and prepared for publication. The experiments proved very time consuming and challenging. In particular, measurement of a spatial map at a single delay point as shown in Figure 1 took approximately 10h.