Characterization of the shock-induced phase transitions in Bi and Sn using time resolved synchrotron X-ray diffraction

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Whilst the determination of crystallographic phases at static high pressure is a well established field of research, the structural observation of each phase and their corresponding phase transition boundaries under rapid dynamic compression, (e.g. using ramp- or shock- compression techniques) has been a significant challenge. The first X-ray diffraction (XRD) evidence for a phase transition during shock-wave compression was observed in 1972 [1]. Yet, time-resolved X-ray diffraction of dynamically compressed matter could only be obtained recently by using various large x-ray source facilities, such as KJ laser [2-5], X-ray free electron laser [6-8], and synchrotron [9–12]. Up to now, the differences between dynamic and static data sets have been discussed mostly in terms of the phase transitions kinetics. Observing the structural response of a shocked material now enables rigorous comparisons with the structural phase transitions disclosed by static compression.

In this talk, we will present the results from our first time resolved X-ray diffraction experiments performed at ESRF on ID09 beamline [10, 11]. We will also talk about our future plans and the new prospects offered by the ESRF upgrade.

References

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