

## REAL-TIME SYNCHROTRON STUDIES OF PHASE TRANSITIONS

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We have been using synchrotron-based time-resolved x-ray scattering to examine phase transition kinetics in bulk metallic alloys, block copolymers and thin films. Here we will discuss two such investigations – studies of ordering kinetics in long-period superlattice (LPS) alloys and of C54 phase formation in TiSi<sub>2</sub> thin films.

Long-period superlattice systems are characterized by the existence of an ordered phase in which there is a periodic modulation of the local order between antiphase domains. We have examined kinetics in the classic LPS alloy Cu-Pd, which exhibits both 1-d and 2-d LPS phases, to better understand how such complex structures form. Following a quench of a disordered alloy into the 1-d LPS region of the phase diagram, we find that the satellite peaks indicative of the antiphase correlations grow and narrow much more quickly than do the peaks at the superlattice positions. Meanwhile, the satellite peak splitting, which indicates the average modulation wavelength, changes non-monotonically during the ordering process. During the formation of 2-d LPS structures, a distinct two-step process is seen with initial ordering taking place in a manner similar to that observed in the 1-d case. Only later do nonconservative antiphase boundaries appear that form the 2-d LPS structure. In order to better understand these complex kinetics observations, we have performed Monte-Carlo simulations using effective pair-potentials derived from x-ray diffuse scattering measurements.

Phase transformations in TiSi<sub>2</sub> thin films are technologically important because of the material's wide use in the semiconductor industry. The metastable high-resistance crystallographic phase C49 is typically the first to form when a Ti film is annealed on Si. The formation and growth of the stable desired low-resistance C54 phase from the C49 phase then requires further heat treatment. We have been examining the kinetics of C49-to-C54 phase transformation, focusing particularly on texture evolution and on the effects of Ta interlayers and alloying.