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Superlattice Formation and Charge Density Waves in $TiSe_{2-x}Te_x$
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— Charge density waves (CDW) are spatial modulations of electron density that are accompanied by a periodic lattice distortion that creates a superlattice. CDWs are common in layered structures such as transition metal dichalcogenides such as TiSe2, which undergoes a prototypical CDW transition below 200K. The mechanism behind the phase transition has not yet been settled. Neutron scattering experiments were carried out at NOMAD at Oak Ridge National Lab to investigate the effect of tellurium doping on the CDW transition in $TiSe_{2-x}Te_x$. Data analyzed using real space pair distribution function analysis shows that the local structure cannot be adequately described using the average structure obtained by Rietveld refinement as peak splitting indicates ordering of the Se and Te atoms and a monoclinic unit cell (space group P2/m) that differs from the nominal hexagonal unit cell ($P\bar{3}m1$). Neutron diffraction experiments from BT-1 at the NIST Center for Neutron Research investigating the compositional and temperature dependence of the structure shows a superlattice structure in $TiSe_{2-x}Te_x$ for x = 0.2, 0.25, and 0.5, indicating that superlattice formation is robust to Te doping.

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