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Local lattice dynamic correlation in $\mathbf{FeSe_xTe_{1-x}}$ KEESEONG PARK, DESPINA LOUCA, University of Virginia, Charlottesville, Virginia 22904, USA., JON TAYLOR, ISIS Spallation Neutron Source, Rutherford Appleton Laboratory, Chilton, Didcot OX110QX, UK., JIAQIANG YAN, Division of Materials Science and Engineering, Ames Laboratory, Ames, IA 50011, USA. — With the use of inelastic neutron scattering, the local lattice dynamics were determined for the new Fe-based superconductors, $FeSe_xTe_{1-x}$ with x=0.1, 0.5 and 0.9. The nature of the dynamic pair correlations was characterized above and below the phase transitions. In the x=0.1 sample that is not superconducting(SC), the nearest Fe-Te and Fe-Fe pair correlations gradually disappear with increasing energy by 35 meV. The same energy dependence is observed above and below the magnetic transition. This energy corresponds to the cut-off frequency of the phonon vibrational modes. On the other hand, in the SC x=0.5 and 0.9, the Fe-Fe correlations gain weight just above the elastic, only to be quickly suppressed by 15 meV. This effect is stronger below the transition than above. The Fe-Te correlations that overlap with the Fe-Fe bonds persist in x=0.5 (possibly in x=0.9 as well but are too weak). On the other hand, the Fe-Se correlations persist beyond this energy, and eventually disappear by 30 meV. These differences in the local lattice dynamics between the non-SC and SC might provide a clue towards understanding the phonon contribution to the mechanism of superconductivity in this system.

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