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Ferro-lattice-distortions in Bismuth Sulfide Superconductors ANUSHIKA ATHAUDA, DESPINA LOUCA, Univ of Virginia, CHRISTINA HOFFMAN, Oak Ridge National Laboratory, YANG REN, Argonne National Laboratory, XIANGDE ZHU, SAICHARAN ASWARTHAM, JASMINKA TERZIC, GANG CAO, Univ of Kentucky, YOSHIKAZU MIZUGUCHI , OSUKE MIURA, Tokyo Metropolitan University, Japan, KEITA DEGUCHI, YOSHIHIKO TAKANO, MASANORI NAGAO, National Institute for Materials Science, Japan
— $ReO_{1-x}F_xBiS_2$ (Re = La, Nd and Pr) is an electron-phonon coupled superconductor with the maximum transition temperature of 10.8 K in $LaO_{1-x}F_xBiS_2$ at x = 0.5. The parent phases, $ReOBiS_2$ (Re = La, Nd and Pr) compounds are either bad metals or insulators. The crystal structure of $ReO_{1-x}F_xBiS_2$ is investigated using single crystal neutron and synchrotron X-ray diffraction experiments. In all compositions, a superlattice Bragg pattern was observed on hk0 plane. The Bragg patterns challenge the long-presumed nominal symmetry of BiS_2 superconductors P4/nmm, and other theoretically suggested symmetries. The Bragg structure can be reproduced by a model involving coherent in-plane displacements of the sulfur in superconducting BiS_2 planes. The sulfur displacements produce different Bi-S bond lengths in-plane giving rise to charge fluctuations. The lattice distortions that arise from unstable phonon modes can trap the charge carriers decreasing the number of pairing electrons.

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