"111" iron pnictide superconductors: pressure enhanced superconductivity

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The recent discovery of superconductivity at 26 K of $LaO_{1-x}F_xFeAs$ opened a new door for research in the area of high-temperature superconductors[1]. In Fe-based superconductors, the correlation between the pressure-tuned superconductivity and the atomic structure under pressure plays a key role in the search for new materials as well as in the elucidation of the mechanism of superconductivity in iron arsenide superconductors. We reported recently the effect of pressure on the superconductivity of 111-type $Na_{1-x}FeAs$ that crystallizes into the same structure as that of Li_xFeAs superconductor. It was found that the superconducting critical temperature of $Na_{1-x}FeAs$ can reach a maximum of 31 K at approximately 3 GPa representing the record high for "111" system. To provide insights into the pressure behavior of the 111-type $Na_{1-x}FeAs$, we further performed studies on crystal structural evolution as a function of pressure based on in situ high-pressure synchrotron x-ray powder diffraction data with Rietveld refinements. The non-monotonic $T_c(P)$ behavior of $Na_{1-x}FeAs$ is found to correlate with the anomalies of the FeAs coordination. This behavior provides the key structural information in understanding the origin of the pressure dependence of T_c for 111-type NaFeAs iron pnictide superconductors.

[1]Y. Kamihara, T. Watanabe, M. Hirano, H. Hosono, J. Am. Chem. Soc. **130**, 3296 (2008).