

## PCP5-1

### Superconductivity in Uncollapsed Tetragonal $\text{LaFe}_2\text{As}_2$

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We report synthesis, crystal structure and superconductivity in  $\text{ThCr}_2\text{Si}_2$ -type  $\text{LaFe}_2\text{As}_2$  (La122). La122 was synthesized at 960°C for 1.5 h under a pressure of 3.4 GPa. An as-synthesized La122, which was *not* a superconductor, had a collapsed tetragonal structure with a short  $c$ -axis length of 11.0144(4) Å as observed in  $\text{CaFe}_2\text{As}_2$  under pressure. The collapsed tetragonal transformed into an uncollapsed tetragonal by annealing the as-synthesized La122 at 500°C. The  $c$ -axis length remarkably extended to 11.7317(4) Å and superconductivity emerged at 12.1 K in the uncollapsed tetragonal La122. Ab-initio electronic structure calculations showed that a cylindrical hole-like Fermi-surface around the  $\Gamma$  point that plays an important role for an  $s_{\pm}$  wave pairing in iron-based superconductors was missing in the uncollapsed tetragonal La122 due to heavily electron-doping. Superconductivity in La122 may be closely related to that induced in  $\text{CaFe}_2\text{As}_2$  under pressure.

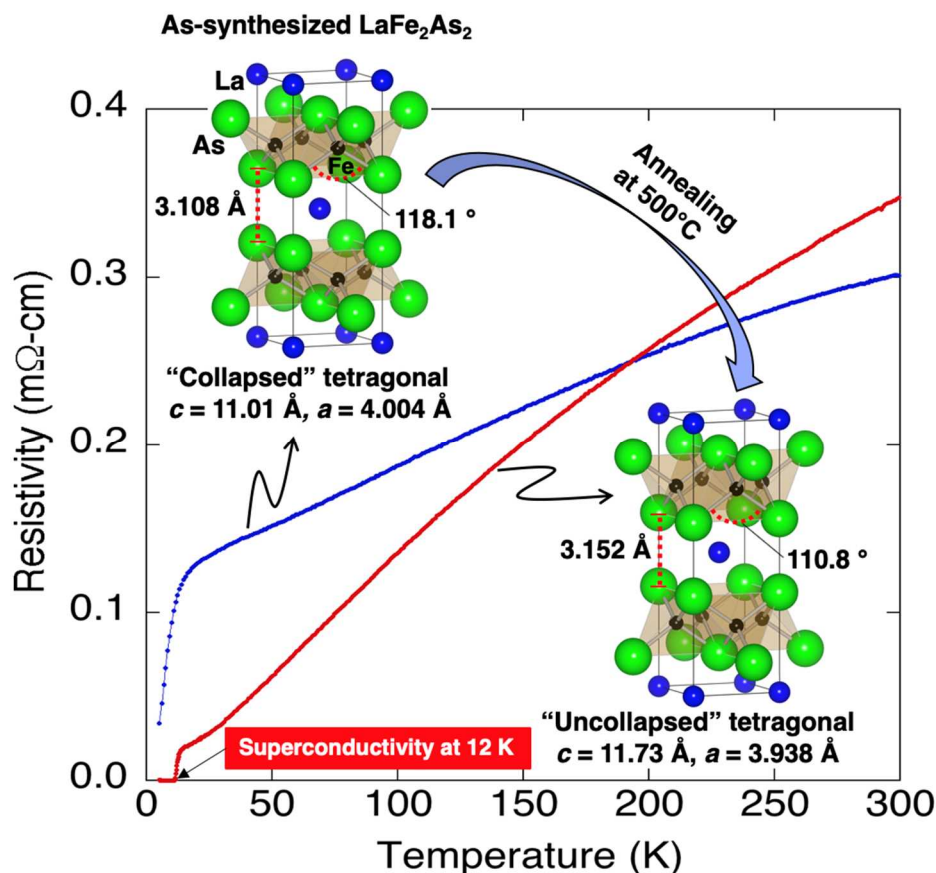


Figure 1 Temperature dependence of resistivity and crystal structures for as-synthesized and annealed  $\text{LaFe}_2\text{As}_2$ .

Keywords: New superconductor, 122-type Iron-based superconductor, Collapsed tetragonal structure, Band structure calculation