

Structural changes of the $\text{Pr}_2\text{Ba}_4\text{Cu}_7\text{O}_{15.8}$ Superconductors under high pressure

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Introduction

After the synthesis of $\text{Pr}_2\text{Ba}_4\text{Cu}_7\text{O}_{15.8}$ (Pr247) and $\text{PrBa}_2\text{Cu}_4\text{O}_8$ (Pr124), it was revealed that the temperature dependence of resistivity in these two compounds is quite unique in contrast to that of $\text{PrBa}_2\text{Cu}_3\text{O}_{7.8}$ (Pr123). As widely known the resistivity of Pr123 synthesized with a conventional method is semiconducting in the whole temperature region below room temperature. In contrast the electrical resistivities of Pr124 and Pr247 are metallic at low temperature.

Recently, we have reported the superconductivity about 18 K in Pr247 which was annealed at 673 K for 48 hours in vacuum [1]. The NQR experiment suggested that the superconductivity in Pr247 is realized in the one-dimensional CuO double chains [2]. The superconductivity of Pr247 was suppressed and disappeared due to applying pressure [3].

In this work, we have investigated the crystal structure of Pr247 means of the synchrotron radiation X-ray powder experiment under high pressure.

Experimental

Polycrystalline samples of Pr247 were synthesized by a solid state reaction method under high pressure oxygen [1]. High-pressure X-ray powder diffraction was performed at PF, BL-18C beamlines at room temperature using a diamond anvil cell (DAC).

Results

Figure 1 shows the XRD patterns of as-sintered Pr247 sample under various pressures. Up to 10 GPa, the diffraction patterns were fitted using the tetragonal $Ammm$ symmetry model. The continuous change of lattice parameters as a function of pressure was observed. Furthermore, we were confirmed the phase transition in Pr247 over 10 GPa.

It is analyzing the crystal structure of the high pressure phase at present.

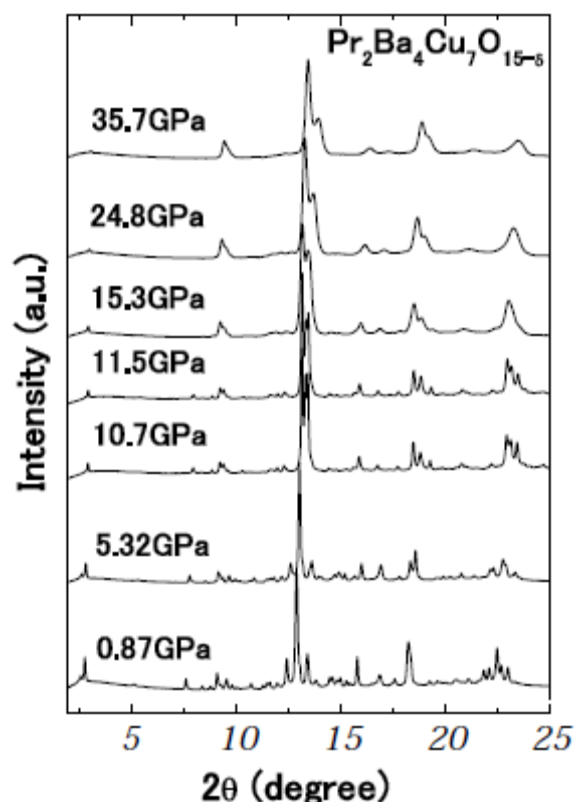


Figure 1. The XRD patterns of as-sintered Pr247 sample under the various pressures at PF, BL-18C. The wavelength of the incident X-ray is 0.6196 Å.

References

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- [2] S. Watanabe *et al.*, *Physica C* **426**, p.473 (2005)
- [3] F. Ishikawa *et al.*, *J. Phys. Soc. Jpn.* **76** Suppl. A92-95 (2007)

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