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### Synthesis and Superconductivity of Pb-based "1-2-0-1" Cuprates

\*Toshihiko Maeda<sup>1</sup>, Ryutaro Koresawa<sup>1</sup>, Aoi Sato<sup>1</sup>, Tamon Wada<sup>1</sup>

Kochi University of Technology<sup>1</sup>

Three kinds of homologous series are known at present in Pb-based cuprate superconductors. Among them,  $(\text{Pb,Cu})\text{Sr}_2(\text{Y,Ca})_{n-1}\text{Cu}_n\text{O}_{2n+3}$  characteristically contains  $(\text{Pb,Cu})\text{O}$  monolayer in its crystal structure and is known to form in an oxidizing atmosphere. In this series, two compounds of  $n=1$  and  $n=2$  have been synthesized. Chemical formula of the former is represented as  $(\text{Pb,Cu})(\text{Sr}_{0.5}\text{La}_{0.5})_2\text{CuO}_5$  ( $n=1$ ;  $(\text{Pb,Cu})$ -"1-2-0-1") in which 50 % of  $\text{Sr}^{2+}$  site is replaced by  $\text{La}^{3+}$ . Synthesis and superconductivity with superconducting transition temperature ( $T_c$ ) of 25 K of this  $(\text{Pb,Cu})$ -"1-2-0-1" are reported for the first time by Adachi *et al.* [1,2]. For this compound, however, it has not been made clear how the charge carriers responsible for superconductivity forms. In this study, effects of oxygen non-stoichiometry on superconductivity of the  $(\text{Pb,Cu})$ -"1-2-0-1" are investigated. Additionally, we have attempted to substitution effects of Nd and Sm for La on phase formation of  $(\text{Pb,Cu})$ -"1-2-0-1".

Samples are prepared by a solid-state reaction method of  $\text{PbO}$ ,  $\text{CuO}$ ,  $\text{SrCO}_3$  and  $\text{RE}_2\text{O}_3$  (RE: La, Nd and Sm) using nominal compositions of  $(\text{Pb}_{0.5}\text{Cu}_{0.5})(\text{Sr}_{1-x}\text{RE}_x)_2\text{CuO}_z$  ( $x=0.0$  to  $1.0$ ). For the former, calcination and sintering are carried out respectively at  $850^\circ\text{C}$  for 10 h in air and at  $950$ - $1050^\circ\text{C}$  for 2 h in air or flowing  $\text{O}_2$  gas. Some samples are subjected to quenching procedure, *i.e.*, after post-annealing at  $800^\circ\text{C}$  for 1.5 h in air, samples are rapidly cooled on a copper plate in air. For the latter, calcination and sintering are carried out respectively at  $800^\circ\text{C}$  for 12 h in air and at  $850$ - $920^\circ\text{C}$  for 10 h in air or flowing  $\text{O}_2$  gas. Samples are characterized by means of powder X-ray diffractometry ( $\text{CuK}\alpha$ ;  $\theta$ - $2\theta$ ) and temperature dependence of electrical resistivity ( $\rho$ ) is measured by a four-probe method.

For the case of  $\text{RE}=\text{La}$ , superconductivity is observed for samples of  $x=0.4$ ,  $0.5$  and  $0.6$ , and  $T_c$  tends to be raised by the quenching. Only these three samples contain  $(\text{Pb,Cu})$ -"1-2-0-1" as a dominant phase. Effects of oxygen nonstoichiometry on superconductivity are now being investigated. For the cases of  $\text{RE}=\text{Nd}$  and  $\text{Sm}$ , formation of the "1-2-0-1" phase are not observed.

Keywords:  $\text{Pb}$ -"1-2-0-1", Cuprate superconductor