STRUCTURE AND SUPERCONDUCTING PROPERTIES OF $[(Ln_{1-x}Ln^*_x)_{1/2}(Ba_{1-y}Sr_y)_{1/3}Ce_{1/6}]_8Cu_6O_z$

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ABSTRACT

A variety of new oxide superconductors that can be represented by the formula, $[(Ln_{1-x}Ln^*_x)_{1/2}(Ba_{1-y}Sr_y)_{1/3}Ce_{1/6}]_8Cu_6O_z$ (Ln, Ln* = lanthanide elements), have been prepared. The crystallographic structures of the oxides were all tetragonal and of the $(Ln^+,Ce)_4(Ln^+,Ba)_4Cu_6O_z$ (Ln^+ = Nd, Sm or Eu) type which had been previously discovered by Akimitsu et al. As the Sr content, y, increased when Ln=Ln*=Nd, the oxygen content, z, monotonically increased and the superconducting transition temperature, T_c, varied exhibiting a maximum. When z was controlled directly by means of high oxygen pressure sintering techniques, T_c was changed accordingly. T_c's of samples with different combinations of Ln and Ln* and different values of x and y were found to depend on the magnitude of the bond valence sum for a Cu atom located in the bottom plane of the $Cu\text{-}O_5$ pyramid. Transport and magnetization measurements were carried out to investigate the magnetic field dependence of superconducting properties and to determine the phenomenological parameters. The Hall coefficients were positive below room temperature and varied yielding a maximum with respect to temperature.