Polarization dependence XANES study on $Bi_{2-y}Pb_ySr_{2-x}La_xCu_{6+\delta}$ single crystals

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X-ray absorption spectroscopy (XAS) has been used to determine the hole concentration for high T_C polycrystalline materials. However, until yet some difficulties with single crystals appeared. By considering the geometrical differences between single- and polycrystals, polarization dependent XAS measurements on $Bi_{2-y}Pb_ySr_{2-x}La_xCu_{6+\delta}$ single crystals was done to evaluate the hole concentration on single crystals. The CuL_{III} edge is evaluated for a quantitative investigation. The satellite peak of the CuL_{III} edge displays the overlap of Cu states with oxygen hole states localized in the CuO_2 planes. Besides measuring the carrier concentration, it can be used to study the distribution of carriers residing in the CuO_2 planes. The specificity to holes solely of the CuO_2 planes is due to the fact that XAS is a local probe and therefore detects only holes near O sites. We had observed an interesting small variation of the absorption strength with respect to the angle of the incoming linearly polarized light on a scale of 10-15%. Thus, this may give an insight on the distribution of hole states in the CuO_2 planes. By proper incorporation of a geometry factor and 10-15% modulation, we found that the hole concentration decreases systematically with increasing La content for single crystals.

9.7 cm

13.4 cm

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