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A Study of Thermal Conductivity of High - T_c Super Conductors

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ABSTRACT

The paper presents a method of evaluation of thermal conductivity of high T_c superconductivity as a function of temperatures. The high Tc superconductors are La_{2-x} Sr_xCuo_4 of difference volumes of x (as x=0.15, T_c=38k and x=0.20, T_c =30k) and $YBa_2Cu_3O_{7-s}$ (T_c =92k) we have compared our theoretical results with that of Graebner[20] and Morelli[21]. Our theoretically evaluated results are in good influent with these workers. Our theoretical results indicate that thermal conductivities of the above superconductors increases with temperature. As it was pointed out by Uher et al[22] that phonons contribute close to 90% of the thermal conductivity in $YBa_2Cu_5O_{7-8}$ at T_c. Given the relatively large magnitude of T_c for $YBa_2Cu_3O7_-$ (Tc/ debye^{2}0.25). It is possible that the transition occurs in a region were the thermal conductivity's is limited mainly by phonon- phonon and carriers-phonon scattering. The enhancement of the thermal conductivity above the normal state conductivity for T<Tc in $YBa_2Cu_5O7_-$ in consistent with this interpretation. It indicates that the phonons make a major contribution to the thermal conductivity and that carrier phonon scattering is important in limiting the phonon contribution to the thermal conductivity at T_c. On the other hand the data for $La_{2-x}Sr_nCuO_4$ are less conclusive. Although phonon makes major contribution to the thermal conductivity at T_c, no clear enhancement is observed as for $YBa_2Cu_3O7_-$ only a slight change in shape is noticeable at T_c. An outstanding of the scattering mechanisms which lead to the low magnitude of the thermal conductivity for $LaCuO_4$ will be important for explains[24,25] the magnitude and temperature behaviour of the thermal conductivity of $La_{2-x}Sr_xCuO_4$.