Thermal and Electrical Conductivity of Layered $Nb_{1-x}Sn_xSe_2$ Crystals

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The thermal conductivity λ (x = 0, 0.15, 0.3, 0.6; T = 2, 200 K) and electrical resistivity ρ (x = 0, 0.15, 0.3, 0.4, 0.45, 0.5; T = 6, 300 K) of layered crystals $Nb_{1-x}Sn_xSe_2$ in the **ab** plane have been measured. The change of the character of the $\rho(T)$ dependence from metallic to semiconductor-type has been found at $x \approx 0.5$. For x = 0.15 and x = 0.3, the increase of thermal conductivity with increasing temperature at T > 90 K correlating with the nonlinearity of $\rho(T)$ dependence in the same temperature range was observed. It may be consistently interpreted assuming that the Fermi level is situated near a sharp peak of electron density of states. The absence of such an increase of thermal conductivity for the sample with nonmetallic electron conductivity (x = 0.6) indicates that this feature is directly connected with the electron subsystem. For the approximation of the temperature dependences of the electron and phonon parts of the thermal conductivity in the superconducting state, the Bardeen-Rickayzen-Tewordt theory has been used. The magnitude of energy gap is found to be smaller then in conventional superconductors that may be an evidence of energy gap anisotropy. The magnitude and the temperature dependence of the resistivity change with x non-monotonously. The magnitude of the resistive anomaly near 33 K connected with the charge density waves (CDW) transition surprisingly increases with increasing x when x >0.15. The obtained $\rho(T)$ dependences are well approximated in terms of phonon-induced *s-d* transitions and electron-defect scattering.