The Physics of Superconducting Intermetallic Compound Mo_3Sb_7

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Using muon spin relaxation/rotation (μSR), inelastic neutron scattering (INS), electron tunneling spectroscopy and electrical resistivity under pressures we investigated the normal and superconducting state of the superconductor Mo_3Sb_7.

μSR and INS provide evidence for the spin pseudogap opening below T* = 50 K. Based on these data the energy of spin pseudogap of 150(10) K was estimated. The existence of a weak magnetism in the dynamic susceptibility $\chi''(Q,\omega)$ and residual longitudinal field relaxation at 5 K imply a static ordering or quantum fluctuations.

The differential conductance *dI/dV* vs. *V* curve at 4.2 K shows that an energy pseudogap of 2Δ ~ 15(5) meV is formed in the density of states. In the superconducting state, the tunneling spectra exhibit the presence of a BCS-type superconducting gap of $\Delta_{sc}(0)$ ~ 0.24 meV, being to concur with the small gap derived from heat capacity and μ–spin rotation experiments.

A novel pressure-induced spin-density-wave transition in the superconductor Mo_3Sb_7 has been observed in the electrical resistivity and magnetization under hydrostatic pressure. The critical temperature of superconducting Mo_3Sb_7 is found to increase with increasing pressure, from 2.15 K at 0.2 kbar up to 2.37 K at 22 kbar. Above 4.5 kbar, superconductivity exists in parallel with a pressure-induced spin-density wave state, revealed by a sharp jump in the electrical resistivity and a maximum in the magnetization at the phase transition temperature T_{SDW}. The application of pressure shifts T_{SDW} to lower temperatures, from 6.6 K at 4.5 kbar down to 6.15 K at 22 kbar. A strong magnetic field dependence of T_{SDW} and a maximum seen in the magnetization indicate an antiferromagnetic character of T_{SDW}. The pressure dependence of *Tc* and T_{SDW} suggests a competition of the SDW and the superconducting states in this system.