Abstract of Presentation

Ba-122 and La-1111 thin film hybrid Josephson junctions

Abstract :

Thin films of iron-based superconductors (iron pnictides) open the way for fundamental experiments on superconductivity in these new materials. The experimental investigation of the electronic properties of the pnictides a helpful tool to investigate the nature of superconductivity in these materials. Tunneling and Josephson junctions offer ways to measure the energy gap and the symmetry of the order parameter as fundamental properties. If the symmetry of pairing differs from conventional s-wave, the behavior of these junctions will change. There exist some theoretical investigation and proposals to test this new behavior. Thus we started to develop tunneling and Josephson junctions with Ba-122 and La-1111 thin film electrodes prepared by pulsed laser deposition (PLD). The process was performed at the IFW Dresden at room temperature and an additional heat treatment at 950°C in evacuated quartz tubes. The pnictide films were covered with gold and patterned by dry argon etching. The hybrid junctions were completed at FSU Jena with a PbIn thin film counter electrode and normal conducting gold layers as barriers. Resistive measurements show no reduction of the critical temperature of the pnictide electrodes after patterning and preparation of the tunneling window. Depending on the surface quality and the gold barrier thickness the current-voltage characteristics of the junctions shows quasiparticle tunneling or even Josephson effects, respectively. Thus the barrier and interface properties have to be improved to get high quality Josephson junctions. We show first results for Ba-122 with RSJ-like current-voltage characteristics and temperature dependent critical Josephson currents following the Ambegaokar-Baratoff relation. Irradiation of microwaves results in Shapiro steps with a common power dependence. In the case of La-1111 the interface properties have to be further optimized because there is some insulating surface layer.