Príprava a štúdium vlastností MgB2 supravodivých tenkých vrstiev

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ABSTRAKT

The thesis deals with the optimization of the preparation of superconducting MgB2 thin films in order to achieve the best superconducting transport properties. We worked in two steps. We first prepared the precursor MgB by vacuum vapour deposition followed by their ex-situ annealed to recrystallization and creating a thin film of superconducting MgB2.Our goal was to optimize the preparation of films of suitable deposition parameters and especially by ex-situ annealing. The quality of prepared films was affected by two key factors and that was specially the choice of the working gas in which the samples were annealed and annealing temperature. Argon, nitrogen and argon mixture with hydrogen (5%) were used as the working gases. The temperatures of 700, 750 and 800°C was used for annealing, and we studied the influence of temperature and the working gas in the chemical composition, surface topography, structure and transport properties of thin layers prepared.To investigate the chemical composition of the samples we used X-ray photoelectron spectroscopy and energy - dispersive X-ray analysis, the topography of the films was evaluated with atomic force microscopy, the crystal structure was examined by X-ray diffraction and superconducting transport properties were investigated by measuring the R(T), I(V) and jc(T) characteristics.

From the transport measurements, EDX, XPS and XRD analyzes it was clearly visible that MgO layer on the top of MgB2 influence quality of prepared thin layers. We found, that samples annealed in argon and nitrogen paradoxically have better quality than samples annealed in reduction atmosphere. We explained this effect in the thesis by protection character of MgO layer. This layer prevents difussion of mangesium from the thin film to the vacuum chamber during annealing and establish better condition for crystalization grains of MgB2. This hypothesis is clarify by measurement of grain size by X-ray difraction.

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