

SMALL ANGLE NEUTRON SCATTERING STUDY OF PZT FIBERS PREPARED BY SOL-GEL

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High-frequency ultrasonic transducers can be prepared using fine-scale PZT fiber-shaped piezoelectric composites with 1-3 connection. PZT ceramic fibers have been prepared by different methodologies, such as extrusion impregnation and sol-gel. Sol-gel technique offers important advantages in the preparation of complex lead based materials. The high chemical homogeneity levels attained in the preparation of these multicomponent systems, the facility of compositional adjustment, and the possibility of preparing materials with fibrous shapes, make sol-gel quite appropriated for PZT fiber preparation. However the brittleness of the fibers prepared by this technique limits their use. Fine, long and crack free sol-gel PZT fibers are needed. In this work PZT fibers with composition $\text{Pb}(\text{Zr}_{0.53}\text{Ti}_{0.47})\text{O}_3$ have been prepared via sol-gel method using titanium isopropoxide, zirconium propoxide, lead acetate trihydrate, and isopropanol to prepare the precursor sols for fiber drawing. To control the withdrawal of the fibers water and water with different acids (acetic or acrylic or methacrylic) were added to the PZT precursor sol. The obtained fibers were aged at room temperature, dried and then heat treated. The withdrawal of fibers was strongly dependent on the addition of acid and the fibers mechanical properties, gel or heat treated ones, were determined by the acid used. In order to clarify the role played at microscopic level by the different acids in the structure formation, Small Angle Neutron Scattering measurements were performed. The results of these measurements showed that the structure of the gel fibre (dried at room temperature) is strongly dependent on the type of acid whereas heat-treated fibers at 550 °C and 700 °C show a similar structure.

Keywords: Sol-gel processes, Fibres, PZT, Microstructure, SANS