

Dielectrophoretic Assembly of Lead Zirconate Titanate Microtubes

Author(s): V. Koval^{1,2}, S.S.N. Bharadwaja², M. Li³, T.S. Mayer³, and S. Trolier-McKinstry²

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Abstract: Lead zirconate titanate (PZT) microtubes were assembled onto pre-patterned substrates using dielectrophoresis of a colloidal suspension of microtubes dispersed in isopropyl alcohol. High aspect ratio tubes with an outer diameter of 2 μm and length of about 30 μm were prepared by vacuum infiltration of mesoporous silicon templates. An interdigitated electrode structure with gap sizes ranging from 2 μm to 15 μm was patterned on a silicon substrate via conventional lithography. This allowed a non-uniform alternating electric field to be generated. The influence of the electrode gap along with the effects of the waveform, amplitude and frequency of an applied signal on the dielectrophoretic assembly of PZT microtubes was investigated. A square wave signal of 5 V(rms) and 10 Hz was found to be the most effective in assembling the microtubes on a 12 μm electrode gap. The results show potential for the dielectrophoretic technique in realizing integrated 3D devices using the high aspect ratio piezoelectric tube structures as building blocks.

Addresses:

1. Slovak Acad Sci, Inst Mat Res, Kosice 04353, Slovakia
2. Penn State Univ, Mat Res Inst, University Pk, PA 16802 USA
3. Penn State Univ, Dept Elect Engn, University Pk, PA 16802 USA

E-mail Address: vkoval@imr.saske.sk