

**Non-linear piezoelectric properties of the thin $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (PZT) films
deposited on the Si-substrate**

J.Nosek¹, M.Sulc¹, L.Burianova¹, C.Soyer², E.Cattan², D.Remiens²

¹Technical University Liberec, International Center for Piezoelectric Research, Halkova 6,
CZ-461 17 Liberec 1, Czech Republic, e-mail: jaroslav.nosek@vslib.cz

²Université de Valenciennes, IEMN – DOAE - MIMM, F-59600 Maubeuge, France

Abstract

In this paper some non-linear piezoelectric properties are investigated in lead zirconate-titanate $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ (PZT) thin films, sputtered on the Si/SiO₂/Ti/Pt substrates. The thin PZT films were optimised by technology conditions (sputtering, $(\text{Zr}_x\text{Ti}_{1-x})$ composition, PZT film thickness, buffer and seeding layers thickness). The significant piezoelectric response for PZT(60/40) rhombohedral compositions, (111) orientations and thickness of 1.02 to 2.2 μm has been observed. The effective piezoelectric coefficient $d_{33} = 225$ pC/N was found for high electric field of 10 MV/m. The non-linear piezoelectric response, depending on electric field, frequency and temperature, was studied experimentally using an original double-beam laser interferometer and an optical cryostat. The temperature dependence of the thickness strain was investigated by laser interferometer in the temperature range – 33 °C to 57 °C.

The $\text{Pb}(\text{Zr}_x\text{Ti}_{1-x})\text{O}_3$ - Si/SiO₂/Ti/Pt samples were prepared in the University of Valenciennes (France), and measured in the Laboratory of laser interferometry at the Technical University of Liberec (Czech Republic).

Keywords: A. Films, C. Piezoelectric properties, D. PZT, E. Actuators, Laser interferometry.