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CHARACTERISATION OF THERMALLY POLED SILICA GLASS USING THE LASER-INDUCED PRESSURE PULSE PROBE TECHNIQUE

P.G. Kazansky, A.R. Smith and P.St.J. Russell
Optoelectronics Research Centre, University of Southampton,
Southampton SO17 2BJ, United Kingdom

G.M. Yang and G.M. Sessler
Institute for Electroacoustics, Technical University of Darmstadt,
Darmstadt D-64293, Germany

A recent breakthrough in nonlinear optics of glass is the observation of high permanent second-order nonlinearities (SON) of the order of 1 pm/V in thermally poled fused silica glass [1] and 0.2 pm/V in thermally poled optical fibres [2]. Despite the plethora of poling techniques, the mechanism behind the formation of SON is not yet fully understood.

Here we report for the first time the use of the laser-induced pressure pulse (LIPP) method [3] to map the charge profiles in our poled silica glass samples. Single laser pulses of about 70 ps duration and 50 mJ energy, generated by a Nd:YAG laser are incident on a absorbing layer coated on to the sample. This creates acoustic pulses of less then 500 ps duration in the sample (Fig.1). This pulses causes any charge to move, giving rise to electrical current proportional to the charge density (Fig.2). Initial experimental tests of silica glass samples ~100 μm thick show a negatively charged layer to be located 5.5 μm from the anodic surface, followed by a positively charged layer at the surface. The implications of these measurements, and an up-to-date progress report on the results of the technique, will be discussed.

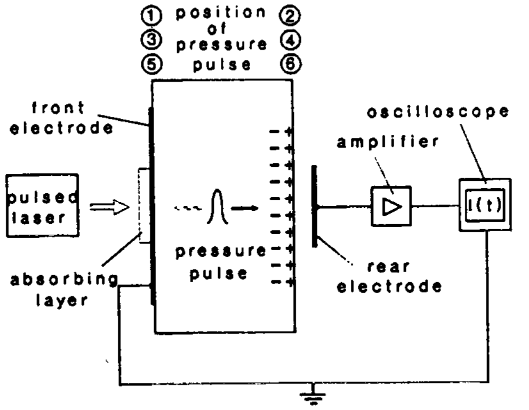

Fig.1 Experimental setup for the LIPP method

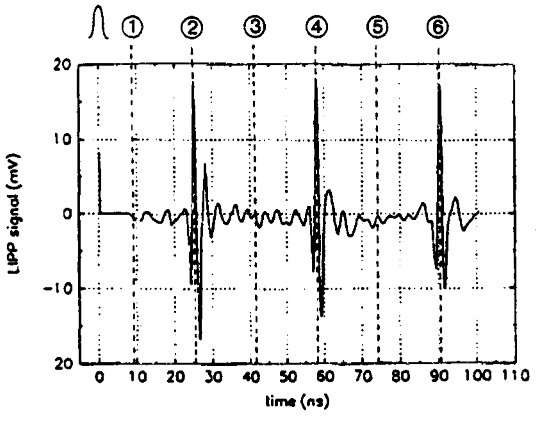

Fig.2 LIPP signal as function of time

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2. P.G. Kazansky, L. Dong and P.St.J. Russell: Optics Letters **19**, 701 (1994).
3. G.M. Sessler, J.E. West and G. Gerhard: Phys. Rev. Lett. **48,** 561 (1982).