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Nonlinearity in poled Tin-doped silica samples fabricated by sol-gel technique

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Since its first proposal quasi-phase-matching (QPM) has been implemented in many materials to achieve efficient second-order nonlinear optical interactions. QPM provides flexibility and new possibilities for phase-matching, especially in materials where the birefringence is not high enough to compensate for the dispersion. Periodic poling of silica fibres exploits the potential of the QPM technology to extend the possibility of efficient frequency conversion to materials which have a widespread use in optical applications and offers several advantages. Thermal poling is the most reliable technique in terms of reproducibility and long-term stability of the induced nonlinearity. In this paper we present the results on induced nonlinearity we have achieved with thermal poling in two tin-doped silica samples fabricated by sol-gel technique [1]. The tin-content was estimated to be ~1.2 and 6 %w/w. While the sample with lower Sn concentration appeared to be a glass, in the sample at high concentration, SnO_2 segregated to give a glass ceramic.

The second-order optical nonlinearity induced in glass by poling has been evaluated through a Maker fringe technique [2]. The second harmonic signal recorded for the poled samples is shown in figure 1. Data were fitted with d_{33} as free parameter. Assuming a nonlinear thickness of 5 μm in the tin-doped samples, d_{33} is found to be ~0.20 pm/V. The results confirm the good non-linearity of silica-based poled material prepared by sol-gel, whereas no relevant effects can be ascribed to the different phases of the SnO_2 dopant at the indicated poling conditions.

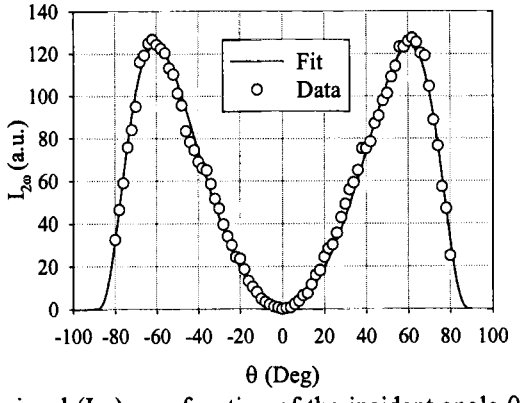

Figure 1: Second harmonic signal ($I_{2\omega}$) as a function of the incident angle θ, for the poled glass-ceramic sample ([SnO_2]~6%). The line represents the best fit achieved with d_{33}=0.2026 pm/V.

References

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