

Electrical second harmonic generation by TGSe and TGS-Se in the autostabilized state

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MS received 3 December 1979; revised 5 May 1980

Abstract. Second harmonic generation and TANDEL effect studies on ferroelectric triglycine selenate and triglycine sulphate-Selenate crystals near the Curie temperature indicate that the generated second harmonic is linear for low biasing fields with a zero off-set, while it decreases sharply at higher biasing fields. In the autostabilized state, the TANDEL elements adjust their impedance against the variation of a.c. field. The experiments on annealed crystals establish that the zero offset is due to the internal bias that owes its origin to the defect structure.

Keywords. Second harmonic generation; ferroelectrics; thermoautostabilized state; (TANDEL); internal bias; defect structure.

1. Introduction

Glanc *et al* (1963, 1964a, b) and Fousek (1965) reported the use of triglycine sulphate as a thermo-autostabilized nonlinear dielectric element (TANDEL). Abe *et al* (1971) studied the second harmonic generation in TGS employing an elaborate external temperature control system and suggested its use in electrometer circuits. Second harmonic generation in the state of temperature autostabilization has been studied, for TGS by Malek *et al* (1964). Similar effect is observed for BaTiO₃ and KH₂PO₄ by Miller (1964).

A zero off-set in the second harmonic versus d.c. bias plots for TGS i.e. the generation of second harmonic without any external bias has been observed by Abe *et al* (1971) and Mansingh and Prasad (1977). TGSe and TGS-Se are also expected to show temperature autostabilization with an advantage of being useful in electrometer circuits requiring additional parameters. Mansingh and Prasad (1977) studied the proportionality of the electrical second harmonic generation in the autostabilized state of ferroelectric TGS. The origin of this off-set is not clearly understood. Mansingh and Prasad (1977) suggested that it might be due to the presence of defects giving rise to internal bias.

In this present paper, we report our studies on TGSe and TGS-Se TANDELS and the results of the experiments on as-grown and annealed crystals.

2. Experimental

Large crystals of TGSe and TGS-Se were grown from solutions prepared by reacting an aqueous glycine solution with proper amount of the corresponding (sulphuric/