A FAR INFRARED PIEZOELECTRIC DETECTOR

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We have recently described a "type II detector" (1) which is closely related to the well-known edge-electrode pyroelectric detector, but has the advantage of a great simplicity. To make such a type II detector, it is only needed to evaporate two closely separated electrodes on the planar face parallel to the polar axis of a pyroelectric crystal: Fig. 1 gives the scheme of two such detectors separated by a distance $D = 3$ mm along the $A_2$ pyroelectric axis of a triglycine sulphate single crystal. The length of each target is $l = 2$ mm and the distance between two electrodes is $d = 0.1$ mm.
Fig. 1: Scheme of a pair of type II detectors.

The infrared signal is given by a Q switched CO$_2$ laser giving 900 W pulses 20 µs long every 1.25 milliseconds. The pulse is focused on the upper type II detector giving a voltage $V_o$ which is displayed on a cathode Ray Oscilloscope (C.R.O.) (fig. 2). The peak signal is $V_o = 120$ mV. It is seen on same fig. 2 (lower part) that a signal $V_D$ is received on the lower detector with a non-observable delay (smaller than 0.05 msec). For a sine thermal wave at $f = 5 \times 10^6$ Hz the delay should be 1 msec. We conclude that $V_D$ is arising from an elastic surface wave and, in fact, we detect an elastic wave and not a thermal wave. We have indeed a piezoelectric detector.