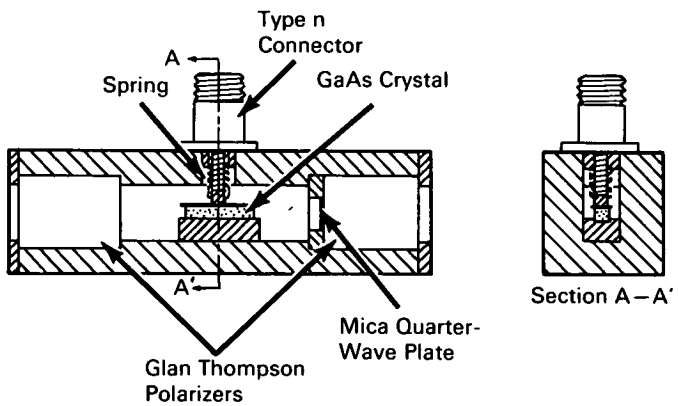
NASA TECH BRIEF

Electro-optic Modulator for Infrared Laser Using Gallium Arsenide Crystal



A gallium arsenide (GaAs) electro-optic modulator for infrared lasers has been developed. The modulator, incorporating a large GaAs crystal with a mica quarter-wave plate and two calcite polarizers, can be used to amplitude- or phase-modulate an infrared laser light source in the wavelength range from 1 to 3 microns. In this range, modulation depths in excess of 50 percent over a bandwidth from dc to above 300 MHz are achieved with an applied voltage of 400 volts rms.

The large single crystals of gallium arsenide used in the modulators were grown by the horizontal Bridgeman technique. They have uniformly high resistivities (exceeding 10^6 ohm cm), are strain-free, and are comparable in quality to that of good optical glass. The small size and poor electrical and optical quality of most electro-optical crystals previously available have limited their usefulness as laser modulators.

The illustration shows cross sections of a complete modulator unit. The GaAs crystal, mounted on the end of a 50 ohm coaxial line, presents a 3 picofarad capacitive load to the line. Openings in the mount for passage of the laser beam are cutoff waveguides at the modulation frequencies to prevent radiation of the modulating signal. The angular aperture (greater than 12 degrees) of the device is limited by the size of the polarizers, which have a 1-centimeter aperture. Wavelength response of the modulator can be shaped by using different wave plates. The operating wavelength can be increased by providing a proportionate increase in the operating voltage.

Note:

Complete technical details may be obtained from:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
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No patent action is contemplated by NASA.

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