TABLE I. Measured isotropic elastic moduli of polycrystalline MgO, CaF_2, β-ZnS, ZnSe, and CdTe.

Specimen	Density (g/cm^3)	Elastic modulus[a] Young's	Shear	Longitudinal	Method of measurements
IR–MgO	3.5819(±0.0009)	30.72(±0.12)	12.93(±0.10)	···	Resonance
		···	12.90(±0.03)	33.83(±0.03)	Pulse superposition
IR–CaF_2	3.1792(±0.0008)	10.75(±0.09)	4.07(±0.07)	···	Resonance
		···	4.11(±0.03)	14.87(±0.03)	Pulse superposition
IR–ZnS	4.0791(±0.0009)	8.38(±0.09)	3.18(±0.07)	···	Resonance
		···	3.17(±0.03)	11.98(±0.03)	Pulse superposition
IR–ZnSe	5.2664(±0.0009)	7.46(±0.10)	2.81(±0.07)	···	Resonance
			2.89(±0.03)	9.83(±0.03)	Pulse superposition
IR–CdTe	5.8520(±0.0008)	···	1.40(±0.05)	6.07(±0.06)	Phase comparison
		···	1.38(±0.03)	6.08(±0.03)	Pulse superposition

[a] All values are at 298°K. All moduli are in units of 10^{11} dyn/cm^2.

IR–CaF_2 was 3.1792 (±0.0008) g/cm^3 at 298°K, and this value compares well with an x-ray density of 3.179 g/cm^3 at 298°K. The chemical purity of the specimen was 99.92% CaF_2, and a spectrochemical analysis showed the following impurities: Sr 700, Na 50, Mg 20, Si 3, and Mn 2 ppm with trances of Al, Ba, K, and Li. The IR–CaF_2 was highly translucent in the visible region as in the case of IR–MgO and it had the optical properties corresponding to a single-crystal CaF_2.

C. Polycrystalline β-ZnS

The β-ZnS specimen used in the present program is a typical of Irtran No. 2 material. The measured density was 4.0791 (±0.0009) g/cm^3 at 298°K, and this should be compared with a x-ray density of 4.088 g/cm^3 at the same temperature. The specimen has been referred to as IR–ZnS in the text, and it has a chemical purity of 99.997% ZnS. Among the impurities detected were Si 1 and Pb 1 ppm with traces of Cu, Fe, and Mg. X-ray diffraction patterns indicate the IR–ZnS was composed primarily of β-ZnS (i.e., sphalerite).

D. Polycrystalline ZnSe

One specimen of polycrystalline ZnSe used in the present program is a typical Irtran No. 4 material, and this has been designated as IR–ZnSe. The IR–ZnSe had the bulk density of 5.2664 (±0.0009) g/cm^3 at 298°K and this value compares well with 5.267 gm/cm^3, the x-ray density at the same temperature. This specimen has a chemical purity of 99.995% ZnSe, with minor constituents including Mg 5, Cu 3, B 10, and Al 2 ppm and traces of Cr and Ni. The IR–ZnSe was translucent in the visible region and had the optical properties similar to single-crystal ZnSe.

E. Polycrystalline CdTe

One specimen referred hereafter to as IR–CdTe is a typical of Irtran No. 6 material. The measured density was 5.8520 (±0.0008) g/cm^3 at 298°K and this may be compared with 5.854 gm/cm^3 calculated from the lattice constant[7] of 6.5815 Å at 298°K. The chemical purity of the specimen was 99.98% CdTe and the specimen contained the following impurities: B 10, Si 10, Mg 3 ppm and traces of Al, Ag, and Cu.

2.2. Measurements of Isotropic Elastic Moduli

The present work utilizes primarily a modified Förster-type resonance method in the kilocycle range[8] to determine the isotropic shear modulus and then Young's modulus of a bar-shaped polycrystalline specimen. Two ultrasonic methods[9] (phase-comparison and pulse-superposition techniques due to McSkimin) often used in single-crystal measurements are also used, as complementary methods, for determining the elastic parameters of polycrystalline solids under investigation. Since a detailed description on all of these methods are found in the literature, this description is not reproduced here.

3. EXPERIMENTAL RESULTS

Table I lists the measured elastic moduli for all the polycrystalline specimens considered in the present work. For a given material, two sets of isotropic elastic moduli are entered. One set is the result obtained from the resonance method in the audio-frequency range and

[7] P. W. Davis and T. S. Shilliday, Phys. Rev. **118**, 1020 (1960).
[8] S. Spinner and W. E. Tefft, Proc. ASTM **61**, 1221 (1961).
[9] H. J. McSkimin, *Physical Acoustics*, W. P. Mason, Ed. (Academic Press Inc., New York, 1964), Vol. I-A, Chap. 4.