TABLE 2. Densities, Velocities, and Acoustic Impedances of Various Materials

| Material | $\rho$, g/cm$^3$ | $v_p$, km/s | $v_s$, km/s | $Z_p$ | $Z_s$ | Reference |
|---|---|---|---|---|---|---|
| $\alpha$-quartz | 2.65 | 5.75[a] | 3.92[b] | 15.2 | 10.3 | *McSkimin et al.* [1965] |
| $MgF_2$ [100] | 3.18 | 6.70 | 4.22 | 21.3 | 13.4 | *Davies* [in preparation] |
| Fused quartz | 2.20 | 5.9 | 3.8 | 13.0 | 8.4 | *Peselnick et al.* [1967] |
| Spinel [100] | 3.58 | 8.87 | 6.57 | 31.8 | 23.5 | *Chang and Barsch* [1973] |
| 276-V9 resin (20°C) (Dow-Corning) | - | - | - | 2.2 | 1.0 | *McSkimin and Andreatch* [1962] |

a. For [100] (X-cut).

b. For [010] (Y-cut).

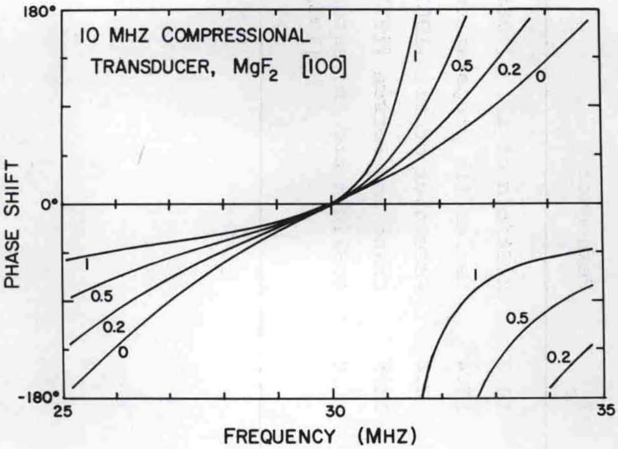


*Fig. 4. Calculated transducer-bond phase shifts for compressional [100] waves in $MgF_2$ with a 10-Mhz quartz transducer bonded to the sample with V9 resin. Curves are labelled with bond transit time $\tau_f$ (nsec). Note that +180° is equivalent to -180° so that the curves in the lower right are continuations of the curves intersecting the upper margin.*

$$\tan \psi_t = \frac{Z_t}{Z_s} \tan \theta_t . \qquad (9)$$

For non-zero bond thickness, the calculated phase shift is not symmetrical. At multiples of the transducer resonance frequency, the effect of the bond is very small, as pointed out by *McSkimin* [1961], but the bond effect can increase quite rapidly away from resonance multiples, especially on the high-frequency side (Figure 4).

Figure 5 compares some measured and calculated phase shifts as functions of carrier frequency. A reference measurement was made using a fused quartz buffer rod bonded to the sample. As described in the next section, the slope of this phase line should be very little affected by the buffer-sample bond. Accordingly, Figure 5 also shows the measured phase residual, with transducer bonded to sample, relative to a line with a slope measured with the buffer rod and coinciding with the measurement of 30 Mhz. The measured residual is compared with calculated transducer-bond phase shifts with $\tau_f$ = 0, 0.1, and 0.2 nsec. The form of the measured residual agrees well with that of the calculated phase shifts, and a value of $\tau_f$ between 0.1 and 0.2 nsec can be inferred from Figure 5. This corresponds to a bond thickness of the order of 0.2 to 0.4 μ, which is perhaps thinner than might have been