$$\frac{\varepsilon''}{\varepsilon} = \frac{uH_e}{D(4\pi\delta M)} ,$$

which is not negligible at the lower δM values and must be corrected for.

It is assumed that prior to entrance of the shock wave the material is in a state of magnetic saturation. This is not, in fact, the case for a given applied field H. The actual magnetization can be roughly obtained from the Weiss relation,

$$\frac{M}{M_s} = 1 - \frac{a}{H} .$$

For this material a value of $a = 3.6 \pm .5$ oe was obtained. This correction reaches a magnitude of 2% for the lowest magnetic fields used.

Experimentally the measured value of δM will be less than that predicted by Equation (3.12) and Equation (3.14) for the theoretically dense material. This is due to the porosity of the material. This correction is not concerned with the effect of porosity on the strain field. It is simply that void regions are nonmagnetic and are not contributing to the effect. This is the same correction which reduces the saturation magnetization, M_s, from the theoretical value. To be accurate, one should distinguish between the expressions for the theoretically dense material $(M_s^{th}, \delta M^{th})$ and the porous material $(M_s^{por}, \delta M^{por})$. Then the theoretical prediction of $\delta M^{th}/M_s^{th}$ can be related to the measured value of $\delta M^{por}/M_s^{por}$ through

$$\frac{\delta M^{por}}{M_s^{por}} = \frac{\delta M^{th}}{M_s^{th}} . \tag{4.16}$$

This distinction has not been made in the text but is implicit wherever experiment and theory are compared.

As has been previously mentioned in Chapter II, the correction due to finite strain could be substantial since the shock induced strains obtained in this work are three orders of magnitude larger than strains which occur in magnetostrictive processes. This is considered exhaustively in Appendix III.

Becker-Doring terms, as were derived in Chapter II, are terms in the magnetoelastic energy expression which are quartic in the direction cosines of the magnetization vector. These terms are seldom found to be of significance. Good values do not exist for YIG. The Becker-Doring terms can probably be safely ignored and this has been done in the present work.

The saturation magnetization is temperature dependent and will be subject to change by the adiabatic shock compression. The isentropic temperature change,

$$\Delta T = \frac{\alpha V_o T_o}{C_p} \Delta P,$$

is calculated to be about 2.5°K and 5°K for shock strengths of 20 kbar and 40 kbar, respectively. The saturation magnetization temperature dependence from Table 2,

$$\frac{1}{M_s} \frac{\partial M_s}{\partial T/T_N} = -0.61,$$

predicts changes of -0.25% and -0.5%, respectively, for M_s.

The exchange interaction and hence the saturation magnetization also depends on pressure. Assuming a law of corresponding states,[12]

$$M_s(T)/M_s(0) = f(T/T_N),$$

taking a pressure derivative, and using values from Table 2, one can obtain