one obtains

$$\delta\Phi = bD\left[4\pi\left(M\frac{\rho_o}{\rho} - M_o\right) + \left(\frac{\rho_o}{\rho} - 1\right)H_e\right]\delta t,$$

where M_o is the initial magnetization per unit initial volume and M is the final magnetization per unit final volume. Since

$$D\left(\frac{\rho_o}{\rho} - 1\right) = -u$$

and $M\rho_o/\rho$ is the final magnetization per unit initial volume, the rate of flux change becomes

$$\frac{d\Phi}{dt} = 4\pi bD\delta M - buH_e. \tag{4.10}$$

The first term is the change in flux due to the reduction in magnetization. The second term is the flux change due to motion of the front surface of the

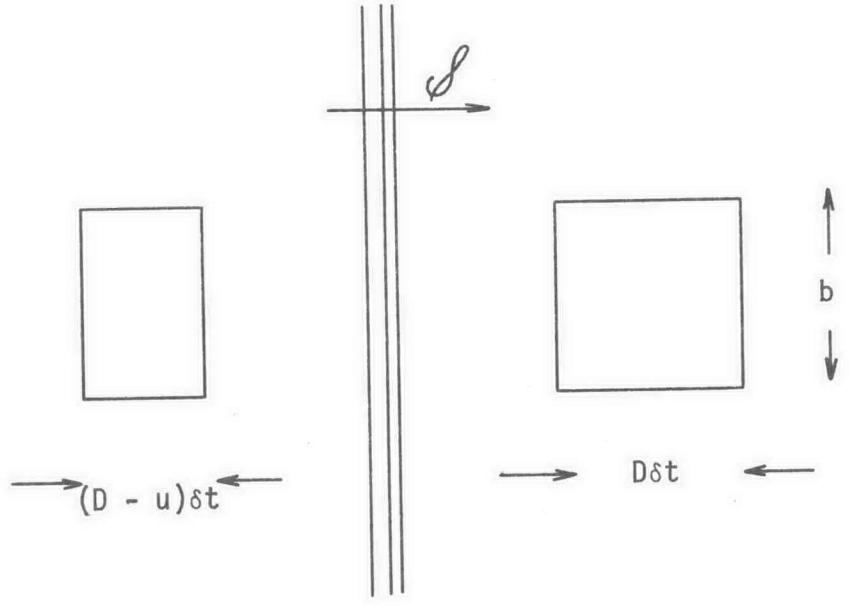

Fig. 4.5.--Geometry for magnetic flux jump condition. Area compression due to shock propagating into medium at rest is represented. Magnetic field is normal to the page.

pickup coil in the manner of a magnetic velocity gauge. When the latter can be neglected,

$$\frac{d\Phi}{dt} = 4\pi bD\delta M. \tag{4.11}$$

Faraday's law

$$\mathcal{E} = 10^{-8} N \frac{d\Phi}{dt} \tag{4.12}$$

relates the induced emf in volts to the turns in the pickup coil and the flux in gauss-cm^2-sec^{-1}. From this, one finally obtains

$$\delta M = \frac{10^8}{4\pi bND} \mathcal{E}$$

$$= \frac{10^8}{4\pi bND} \frac{R + Z}{Z} V. \tag{4.13}$$

Thus, for a steady state shock wave, the induced emf is constant and is proportional to the demagnetization.

4.4. Material

The material selected for this study was hot pressed polycrystalline yttrium iron garnet.[62] It was chosen because the magnetoelastic properties are of convenient magnitude for experimental investigation. This was also the same material used by Shaner and Royce[8] in earlier investigation of the shock induced demagnetization effect at higher stresses. The following paragraphs will present the material characterization performed during this work.

Photomicrographs were obtained of polished sample surfaces. A uniform distribution of highly spherical pores, characteristic of sintered ceramics, was observed. The pore diameters ranged from 1 to 3 microns. There was some evidence of other inclusions.