theory are consistently applied to the problem of shock-induced anisotropy in ferromagnetic material. ⟨100⟩- and ⟨111⟩-oriented single crystals are considered. Using a Landau-Lifshitz domain-wall calculation, wall energies for wall normals parallel and perpendicular to the applied field are obtained. The wall energies are found to be approximately the same, the latter being slightly lower. From this, it is concluded that a needle- or sliver-shaped domain structure oriented along the axis of uniaxial strain is most likely to nucleate behind the shock front.

(iii) A total magnetic energy expression is determined for the ⟨100⟩ and the ⟨111⟩ problems. Assuming the validity of equilibrium thermodynamics behind the shock front, expressions for the domain size and the magnetization curves are obtained.

(iv) The equilibrium exchange and demagnetizing energy is found to increase as the fourth root of the strain while the induced anisotropy energy increases linearly with the strain. Thus, the former term assumes decreasing importance with increasing shock strength. It is found to be negligible in the region of large strain in yttrium iron garnet, and previous treatments[2,5,7] of the shock-induced anisotropy effect, in which the exchange and demagnetizing energy was ignored, are justified in this assumption.

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[1]R.A. Graham, J. Appl. Phys. **39**, 437 (1968).
[2]E.B. Royce, in *Behavior of Dense Media under High Dynamic Pressure* (Gordon and Breach, New York, 1968), p. 419.
[3]R.A. Graham, D.H. Anderson, and J.R. Holland, J. Appl. Phys. **38**, 223 (1967).
[4]R.C. Wayne, J. Appl. Phys. **40**, 15 (1969).
[5]J.W. Shaner and E.B. Royce, J. Appl. Phys. **39**, 492 (1968).
[6]G.E. Seay, R.A. Graham, R.C. Wayne, and L.D. Wright, Bull. Am. Phys. Soc. **12**, 1129 (1967).
[7]L.C. Bartel, J. Appl. Phys. **40**, 661 (1969).
[8]G.E. Duvall and G.R. Fowles, in *High Pressure Physics and Chemistry*, edited by R.S. Bradley (Academic, New York, 1963), Vol. II.
[9]L.C. Bartel, J. Appl. Phys. **40**, 3988 (1969).
[10]C. Kittel and J. Galt, in *Solid State Physics*, edited by F. Seitz and Turnbull (Academic, New York, 1957), Vol. III.
[11]D.E. Grady, G.E. Duvall, and E.B. Royce, following paper, J. Appl. Phys. **43**, 1948 (1972).
[12]Prediction of magnetoelastic behavior in the plastic region of the material (above the Hugoniot elastic limit) requires an additional assumption. A model which distinguishes between elastic and plastic strain is required. Usually a simple elastic-plastic model is used.
[13]W.F. Brown, Jr., *Magnetoelastic Interactions* (Springer-Verlag, New York, 1966).
[14]Magnetic stresses will not be considered in this work. They are on the order of the magnetoelastic constants (about 0.005 kbar in YIG). Stresses of interest in this work are at least three orders of magnitude greater than this.
[15]A.H. Morrish, *The Physical Principles of Magnetism* (Wiley, New York, 1965).
[16]E.W. Lee, Rept. Progr. Phys. **18**, 184 (1955).
[17]J.F. Nye, *Physical Properties of Crystals* (Oxford U.P., London, 1957).
[18]L. Landau and E. Lifshitz, Physik Z. Sowjetunion **8**, 153 (1935).
[19]C. Kittel, Rev. Mod. Phys. **21**, 541 (1949).