and using the identity

$$\cos^2 x = \left(1 - \frac{1}{a^2}\right) + \frac{1}{a^2}(1 - a^2 \sin^2 x),$$

one obtains

$$\sigma_w^p = 4\sqrt{A|be|}(a^2 - 1)\int_0^{\pi/2} \frac{dx}{(1 - a^2 \sin^2 x)^{1/2}} + \int_0^{\pi/2} (1 - a^2 \sin^2 x)^{1/2}\, dx.$$

This is

$$\sigma_w^p = 4\sqrt{A|be|}((a^2 - 1)\, K(a, \pi/2) + E(a, \pi/2))$$

where $a = \sin\theta$ and K and E are complete elliptic integrals of the first and second kind.

σ_w^s and σ_w^p are compared in Figure 3.3. It is seen that the domain model considered in Figure 3.2(b) yields a slightly lower energy. In actual crystalline material, imperfections such as dislocation, impurity, etc. can significantly alter the domain wall energy. For this reason, it is believed that the slight energy difference does not justify the prediction of the domain structure in Figure 3.2(b) over that in Figure 3.2(a). From this, one may conclude that domain theory suggests a needle or sliver shaped domain structure oriented along the axis of uniaxial strain will nucleate behind the shock front. A model for this structure is shown in Figure 3.2(c).

Due to the much simpler form of Equation (3.6), the approximation

$$\sigma_w^p \simeq \sigma_w^s = \sigma_w = 4\sqrt{A|be|}\sin^2\theta$$

will be made. An expression for the effective exchange energy density is given by

$$\mathcal{E}_{ex} = \frac{2\sigma_w}{D}$$

or

$$\mathcal{E}_{ex} = \frac{8\sqrt{A|be|}}{D} \sin^2\theta$$

where D is the dimension of a domain as shown in Figure 3.2(c).

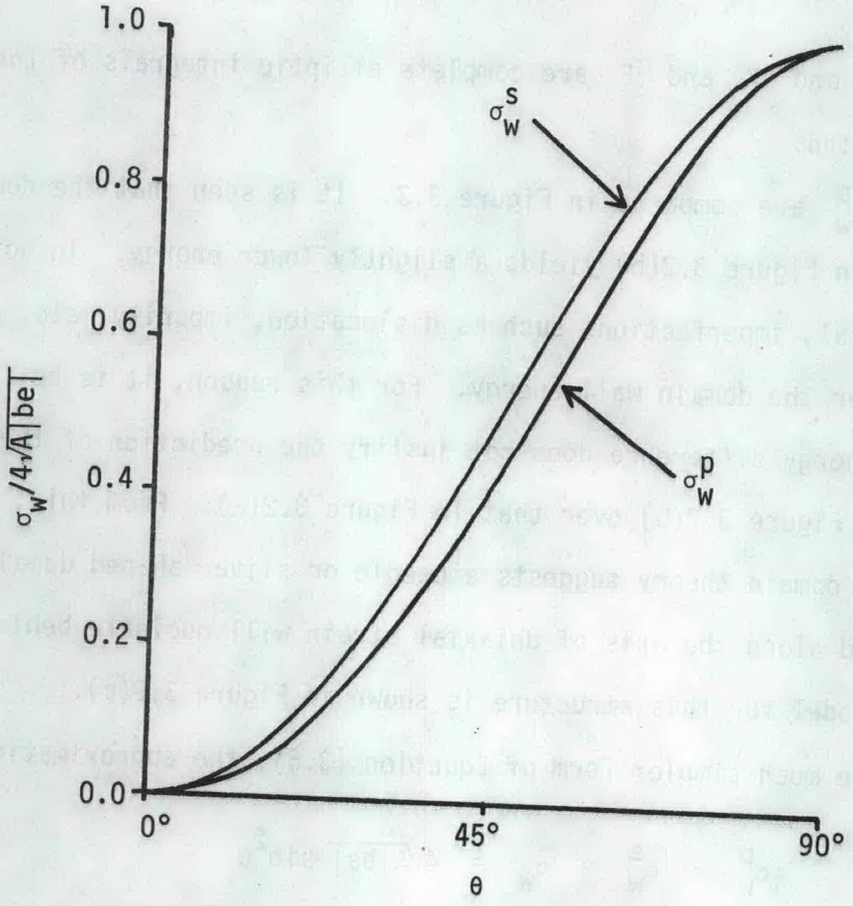

Fig. 3.3.--Domain wall energy as a function of θ. σ_w^s corresponds to the wall geometry in Fig. 3.2(a); σ_w^p corresponds to the wall geometry in Fig. 3.2(b).