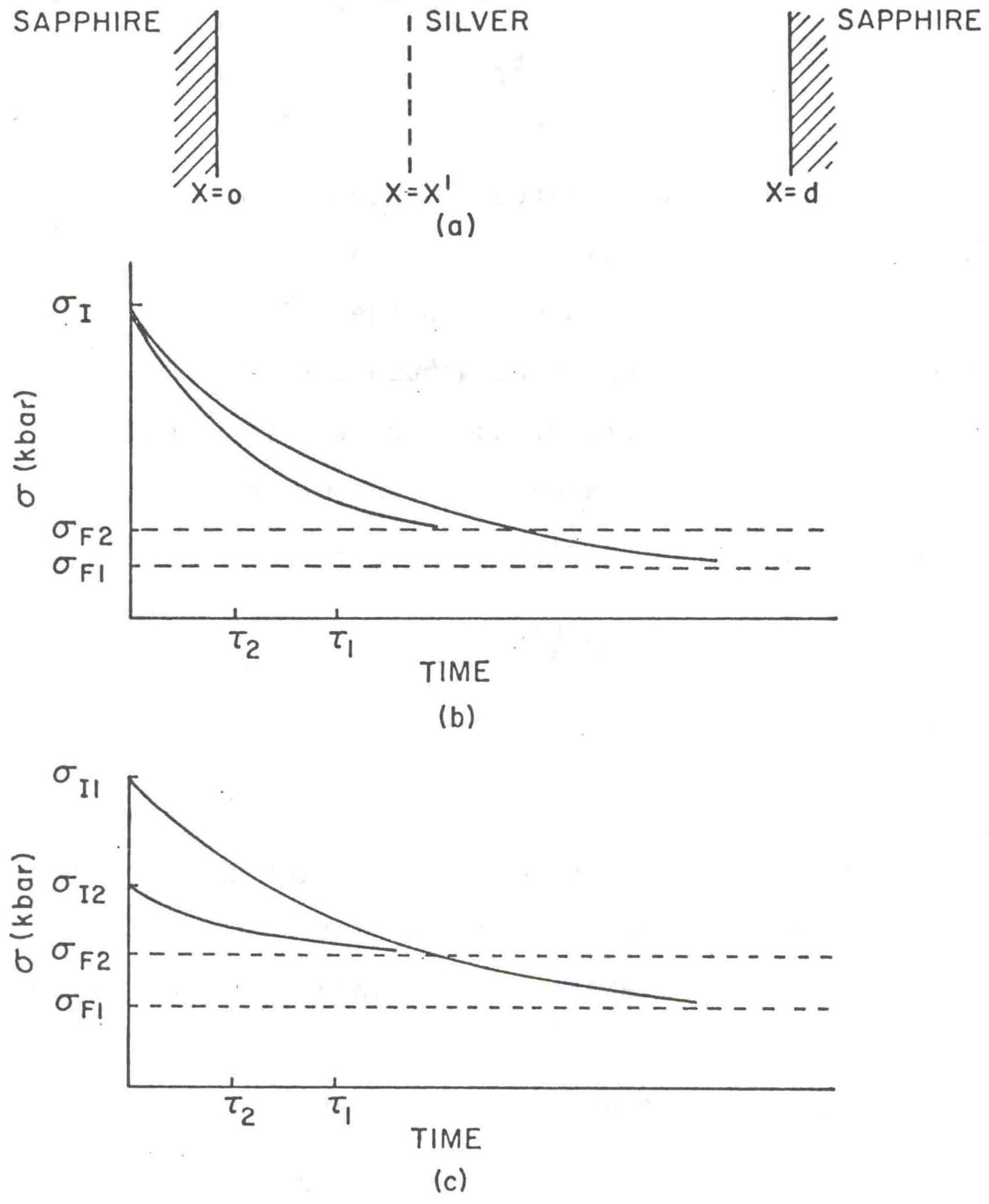

Fig. 16. Stress relaxation dependence on purity. (a) Sandwich configuration; shock wave propagates to the right. (b) Stress relaxation at $x = 0$; material 1 is more pure. (c) Stress relaxation at $x = x'$; material 1 is more pure.

strain be an explicit function of time t. Assuming a Saada-type relation at a given position in the foil (Fig. 16a), we have

$$\chi_{pd} = K \int_0^{t_f} \sigma(t) \frac{d\epsilon}{dt} dt \quad ,$$

where K is some undetermined constant. (Defect concentration will be a function of position because the peak elastic stress decays as the wave propagates into the foil.) The following sample calculation using these assumptions shows that computed defect concentrations are greater for the W3N, more pure silver.

For the sample calculation let us model the relaxation process at a given material point by

$$\epsilon = \epsilon_F\left(1 - e^{-\frac{t}{\tau}}\right)$$

and by

$$\sigma = \sigma_F + (\sigma_I - \sigma_F)\, e^{\frac{-t}{s}}$$

where τ and s are characteristic relaxation times for strain and stress, respectively, ϵ_F is final strain, σ_I is initial yield stress at that material point, and σ_F is the steady state yield stress.

The result for defect concentration is

$$\chi_{pd} = K\sigma_F\, \epsilon_F \left[1 - \exp(-\frac{t_F}{\tau}) + \frac{rs}{s+\tau}\left(1 - \exp(-t_F(\frac{s+\tau}{s\tau}))\right)\right] ;$$

$r \equiv (\sigma_I/\sigma_F - 1)$. For times long compared to relaxation times the result is

$$\chi_{pd} = K\, \sigma_F \epsilon_F (1 + \frac{rs}{s+\tau}) . \qquad (11)$$