Analytical interpretation of stress relaxation behaviors of PET film in aqueous salt solutions and NaOH solution

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The relaxation behaviors of PET film were investigated in aqueous salt solutions (I=0.2 and I=0.6) and NaOH solut-ion (30°C~80°C) by stress relaxation experiments. And to explain the experimental data 5-element mechanical model was used and the constitutive equations corresponding to th-is model were as follows.

I. The initial relaxation state;

$$\sigma(I) = \sigma_1 \exp(-r_f \cdot t)$$
$$= -K_{f1}^* \exp(a_1 \cdot \sigma_1^*)$$
$$(\text{cf. ; } d\log \sigma(t)/dt = -K_f \exp(a \cdot \sigma(t)/\sigma(0)))$$

II. The later relaxation state;

$$\sigma(II) = \sigma_2 \exp(-r_b \cdot t)$$
$$= -K_{f2}^* \exp(a_2 \cdot \sigma_2^*)$$

III. The equilibrium state;

$$\sigma(III) = \sigma_{eq.}$$

For aqueous salt solutions, the relaxation stress was increa-sed with draw ratio, ionic value and ionic strength. This phenomena by ions was due to the compensation effects for hy-drogen bonds and van der Waals' forces of PET.
Whereas the relaxation stress in NaOH solution was increased with draw ratio but decreased with temperature because of

" the activation state of hydrolysis of PET by NaOH solut -ion ". And in NaOH solution two relaxation times of rela -xation spectra from the experimental data were fit with those of the constitutive equations.

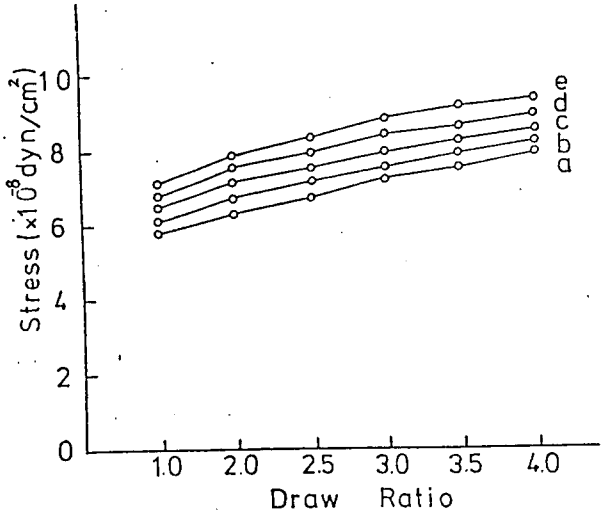

Fig. The initial relaxation stress of PET film in ionic solution.
a: K^{+} b: Na^{+} c: Li^{+} d: Ca^{+2} e: Mg^{+2}

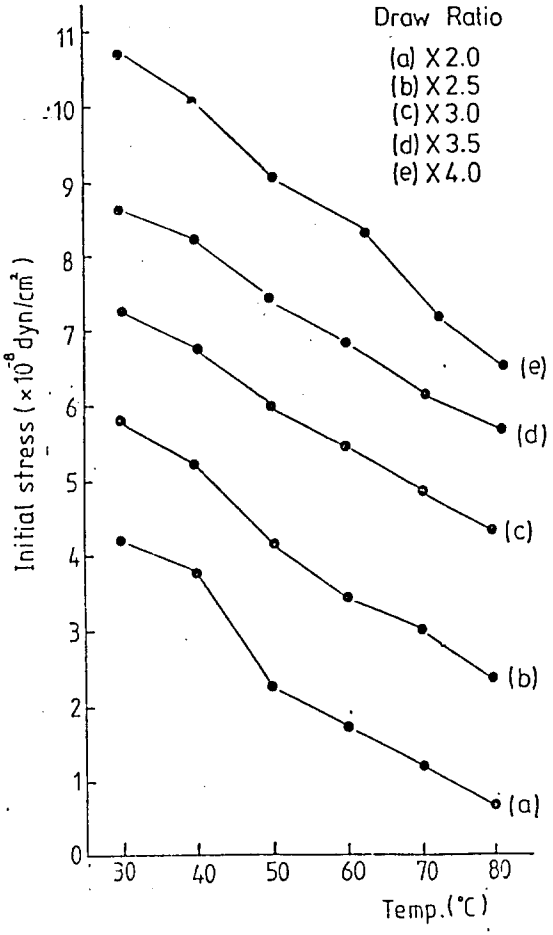

Fig. Initial Stress of PET Film in 0.2 M NaOH Solution.