polymer reports

The stress-strain curve of 1-nylon polymers

M. S. Ahmed*, I. W. Parsons, J. N. Hay and R. N. Haward

Department of Chemistry, University of Birmingham, P. O. Box 363, Birmingham B15 2TT, UK

(Received 14 August 1979)

In a previous publication, we showed that cast films of 1-nylon polymers and copolymers gave stress–strain curves showing uniform extension in a tensile test[1]. This was correlated with the high persistence length of the polymer chain, as has been demonstrated by measurements in solution[2,3]. However, rubbers and soft plastics such as plasticized PVC also extend uniformly, though at relatively low stresses. Thus it is only when the yield stress is high that necking becomes the characteristic response to tension, and when the observation of stress–strain curves with a minimal fall in stress at yield and uniform extension becomes interesting.

We therefore sought to extend our previous results to include materials with higher yield stresses and prepared copolymers of *n*-propyl and ethyl isocyanates by the same methods as previously, but with a higher NCO: hydrocarbon ratio. As before, the copolymers were shown to have a composition close to that of the monomer feed ratio[4], and with the higher NCO content higher yield stresses were obtained.

* Present address: Department of Chemistry, University of Surrey, Guildford GU2, 5XH, UK

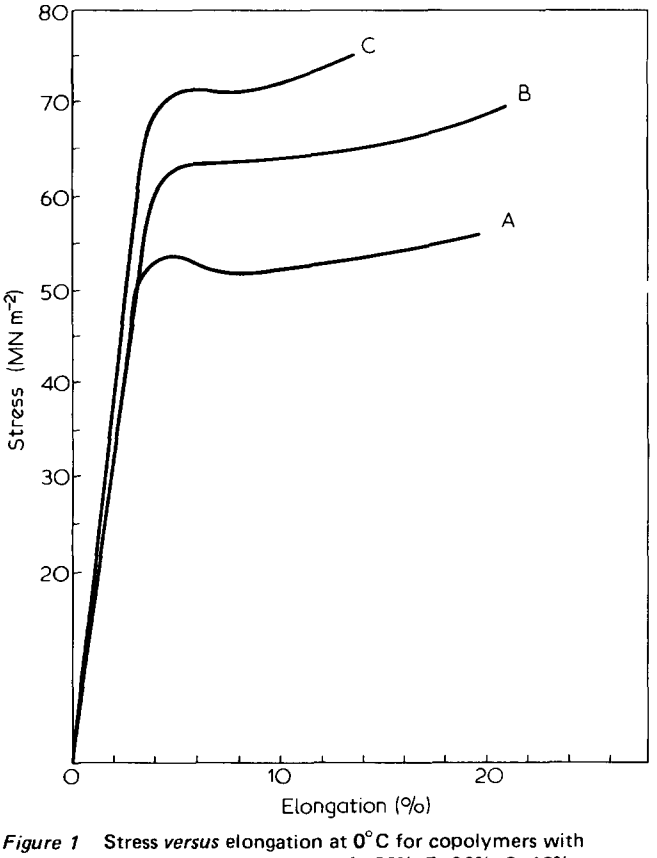

Figure 1 Stress *versus* elongation at 0°C for copolymers with different ethyl isocyanate contents. A, 20%; B, 30%; C, 40%

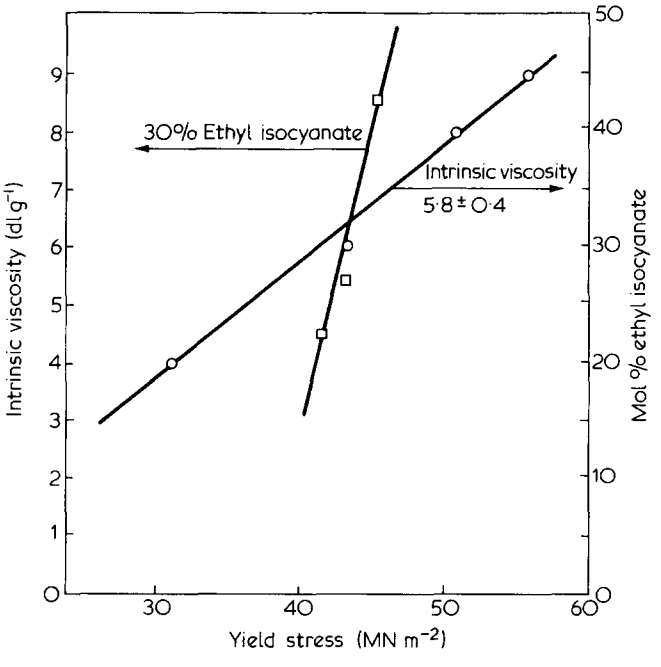

Figure 2 Plots of mol % ethyl isocyanate and intrinsic viscosity *versus* yield stress for copolymers

The results of measurements made at 0°C are given in *Figure 1*. With 40 mol % ethyl isocyanate, a uniform extension was obtained with no significant fall in the engineering yield stress of 70 MN m^{-2} at yield. The polymers also showed a relationship of yield stress to the NCO: hydrocarbon ratio similar to that previously reported (*Figure 2* measured at 23°C). The yield stress was also found to be relatively insensitive to the intrinsic viscosity of the polymer.

References

1 Owadh, A. A., Hay, J. N., Parsons, I. W. and Haward, R. N. *Polymer* 1978, **19**, 386
2 Berger, N. M. *J. Macromol. Sci. (C)* 1973, **9**, 269
3 Bur, A. J. and Fetters, L. F. *Chem. Rev.* 1976, **76**, 727
4 Ahmed, M. S. *MSc Thesis*, University of Birmingham (1978)

0032–3861/80/010116–01$02.00