

## SMALL ANGLE SCATTERING FROM A BLOCK COPOLYMER

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Bisphenol A polycarbonate (BPAC) can be mixed with polydimethylsiloxane (DMS) in solution to form a random alternating block copolymer. The morphology is known to consist of domains rich in one phase dispersed in the second  $1/l$ . Further characterisation of this copolymer is to date not well defined. Small Angle Neutron Scattering (SANS) on this copolymer shows a broad maximum whose position and width depend on the relative concentrations of BPAC and DMS. Presented here is an interpretation of SANS data on a set of different relative concentrations of the two phases.

The SANS data were obtained with the spectrometer at MURR in the  $Q$  range  $0.008 - 0.08 \text{ \AA}^{-1}$  on the following weight concentrations of DMS/BPAC: A; 25/75, B; 50/50, C; 65/35 (block length  $20 \text{ \AA}$ ) and D; 65/35 (block length  $100 \text{ \AA}$ )  $1/l$ . From the positions of the maxima the approximate average inter-domain separations were: A;  $171 \text{ \AA}$ , B;  $118 \text{ \AA}$ , C;  $108 \text{ \AA}$ , D;  $307 \text{ \AA}$ . An attempt to generate the measured peak was made by multiplying a single particle function  $P(Q)$  - obtained from a Guinier fit to the trailing edge - with a pair function  $S(Q)$ . Several  $S(Q)$  forms were tried such as  $(1 - \exp(-kQ))$ ,  $\tanh(Q)$  etc. but agreement of peak position could only be found if the  $g$  value was arbitrarily reduced. Also the shape of the calculated products bore poor resemblance to  $I(Q)$  and  $\ln I(Q^2)$ .

The approach adopted here was to fit the data to a Lorentzian whose width could be related to the range of the scattering potential (in the Born approximation) of each domain. The form chosen was:  $1/l = A + C(Q - Q_{\text{max}})^2$  where  $A$ ,  $C$  are constants. A plot of measured  $1/l$  vs  $(Q - Q_{\text{max}})^2$  (Fig. 1) showed two different slopes indicating different Lorentzians for the leading and trailing edges of each maximum. Accordingly two regression fits were made for each peak and confirmed in  $I(Q)$  (Fig. 2). The difference in the widths of the two Lorentzians was interpreted as a measure of the spread of domain sizes. The average domain sizes from the Lorentzian fits on a relative scale were: A; 1.29, B; 1.28, C; 1.0, D; 3.18. These compared well with Guinier fits to the trailing edge: A; 1.29, B; 1.17, C; 1.0, D; 3.22. In addition the spread of sizes per average size as a function of concentration (Fig. 3) showed a marked increase. Sample D whose block length was 5 times that of C also showed a 5 fold increase in relative spread of domain sizes. Further comparisons in  $1/l$  should confirm the findings quoted here.

<sup>1/1</sup> R. P. Kambour, "Block Copolymers", S. L. Agarwal (ed.) pg. 263, Plenum (1970)

<sup>1/2</sup> B. Hammouda, J.A.E. Desa, A.C. Lind, Proc. SSPS Vol. 30C, 35 (1987)

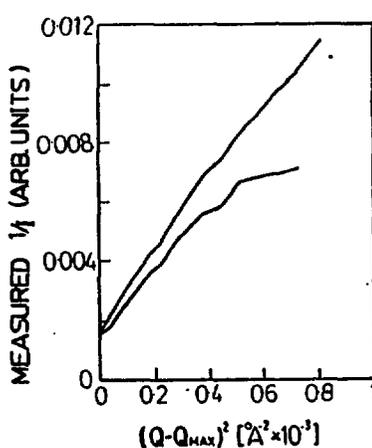


FIG-1

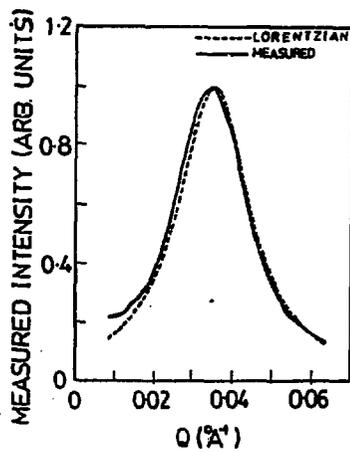


FIG-2

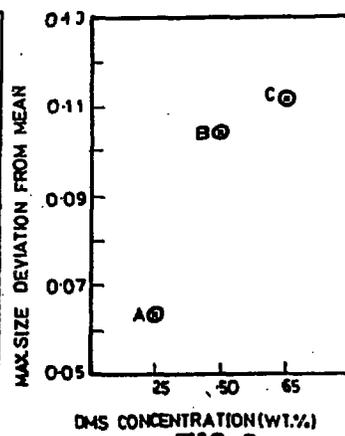


FIG-3