

**Experiment title:**

The role of transient phases in crystallization of polymers

Experiment**number:**

SC- 173

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Report:

Poly-4-methyl-pentene-1 (P4MP1) is a semi-crystalline polymer with an unusual density relationship below the glass transition temperature (50 C), i.e. crystal density (0.813) is less than the amorphous density (0.830). The density relationship is similar to that for ice. In the present set of experiments we explored the influence of pressure on crystal structure below the glass transition temperature. For experimentation we made use of our piston cylinder type pressure cell with diamond windows. To overcome absorption from the diamond windows we made use of monochromatic X-ray wavelength of 0.7Å. In order to achieve the maximum information on the crystal deformation as an influence of pressure we made an oriented tape of P4MP1 (homopolymer). Princeton type 2D-detector was used for the data collection. Fig. 1a-c shows some of experimental observations while raising pressure isothermally at 20C. Fig. 1 d-f shows incoming of pressure induced new phase while increasing temperature isobarically. A series of experiments were performed along three different routes in the pressure-temperature phase diagram. Kinetics of the phase transitions was followed isothermally and isobarically, making use of the high intense X-ray source available at the ESRF.

Fig.1(a) P=1bar, T=25C; **(b)** P=2kbar, T=25C; **(c)** P=3.5kbar, T=25C; **(d)** P=3.5kbar, T=130C; **(e)** P=3.5 kbar, T=170C; **(f)** P=3.5kbar, T=215C

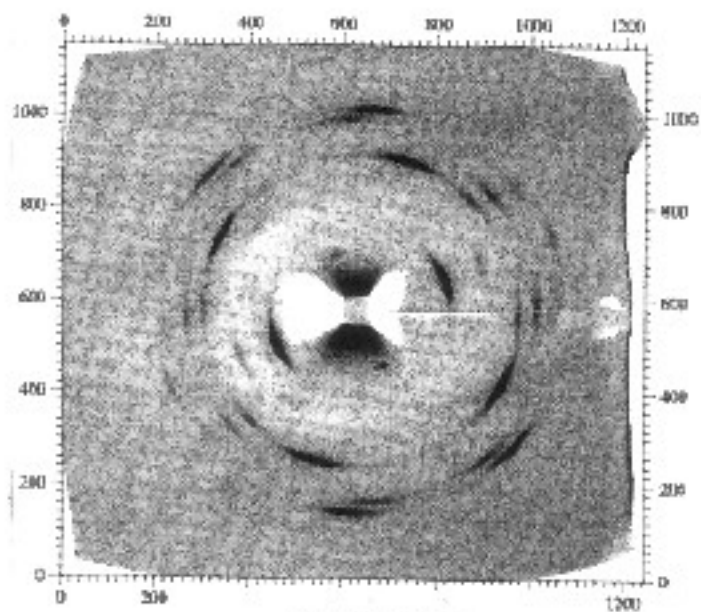


FIGURE 1a

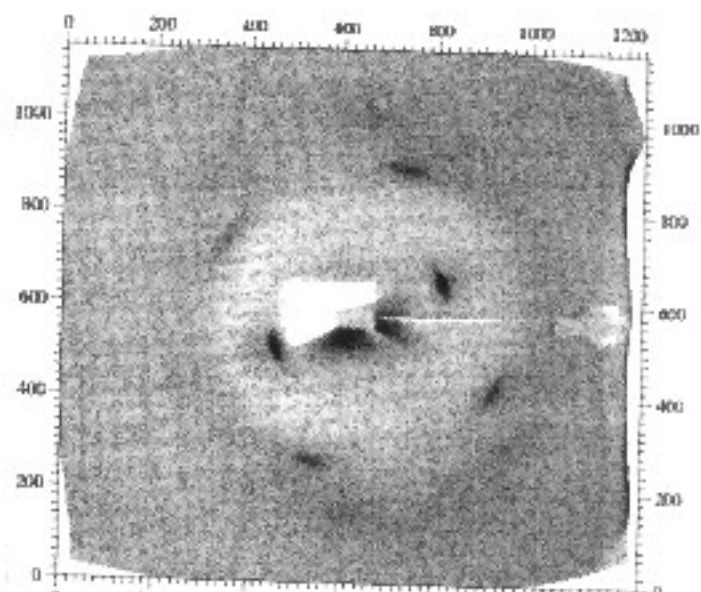


FIGURE 1b

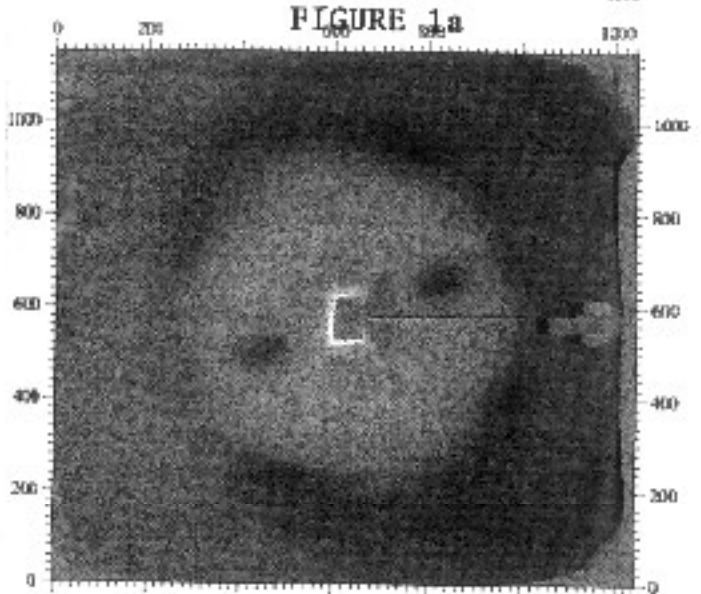


FIGURE 1c

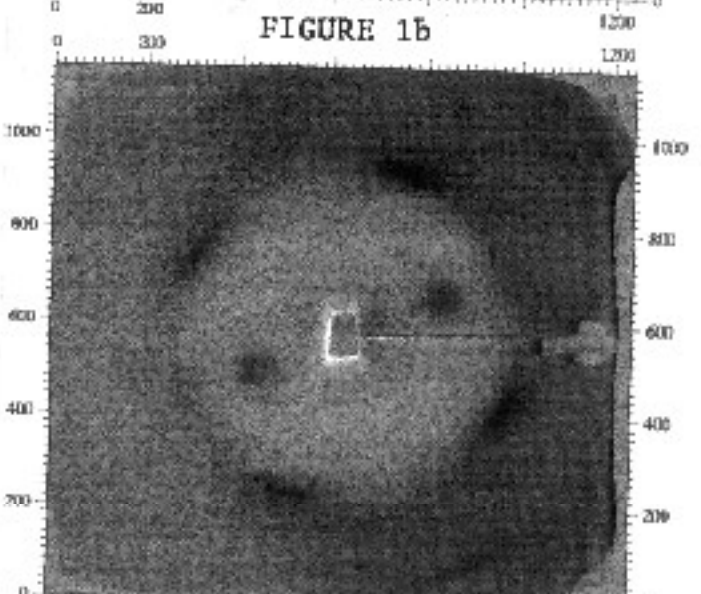


FIGURE 1d

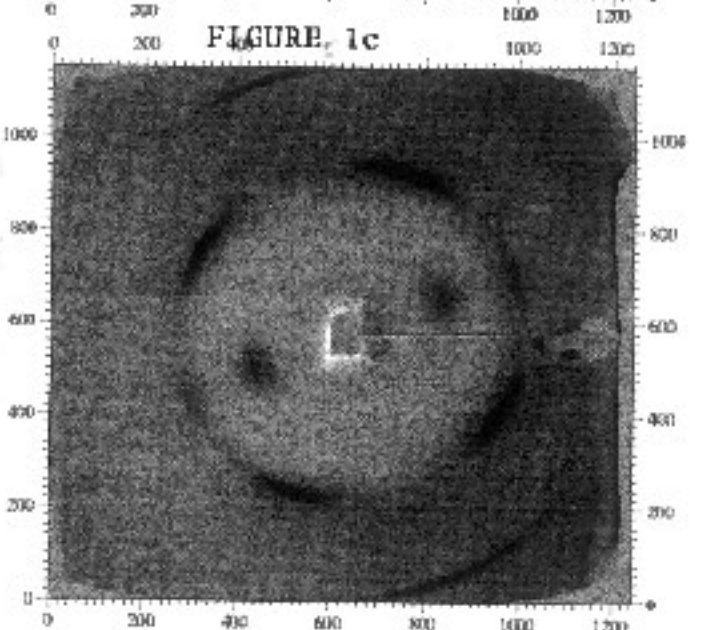


FIGURE 1e

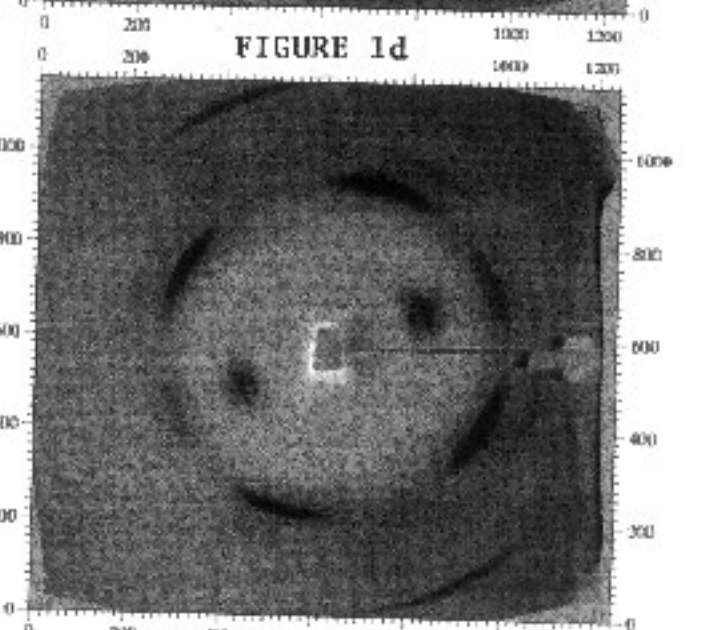


FIGURE 1f