

than for the lower, members in the polyalkyl methacrylate series, excepting PnBMA for which it unexpectedly is larger than for any other polymer studied. The temperature of K(maximum) and another characteristic temperature increased linearly with slopes  $dT/dp$  of about 27, 25, and 16 °C/kbar, respectively, for PMMA, PEMA, and PnBMA, in approximate agreement with Ehrenfest's equation for second order transitions.

\*Supported by the National Institute of Dental Research.  
\*\*Present address: Chem. Dept., Univ. of Kansas.

**EK 8** Physical Properties of Polystyrene Vitri-fied Under Kilo-bar Pressures; W. C. DALE and C. E. ROGERS, Case Western Reserve University--Atactic polystyrene glasses were formed at up to 3000 atmospheres pressure by cooling the polymer melt in a specially designed high precision evacuated compression mold. Property changes induced by this high-pressure history included: a monotonic decrease with molding pressure of the diffusion coefficients of simple gases, a higher compressive elastic modulus, and the appearance of an exothermic dilatational relaxation below  $T_g$  when the samples were heated. The compressive yield stress and gas solubility coefficients went through a maximum and minima respectively at about 1000 atm molding pressure. The observed behavior is interpreted in terms of a model based on pressure-induced heterogeneities in local order. The initial effect of increased molding pressure is to produce a more compact polymer with less segmental mobility and more extensive interchain forces. Above molding pressures of about 1000 atm, a second effect develops due to the apparent formation of localized conformations which are produced by the high-pressure vitrification conditions, but are unstable under room conditions. The spontaneous decay of these high-energy regions leads to subsequent formation of microvoid defects and to more rapid structural relaxation effects.

**EK 9** Infrared Studies of Cryogenic Transitions in Polyethylene Terephthalate and Polystyrene. \* Y. S. HUANG and J. L. KOENIG, Case Western Reserve University. -- Infrared absorbance measurements as a function of temperature down to 13°K have been made on polyethylene terephthalate and polystyrene. Transition temperatures are assigned to the temperatures where there are abrupt changes in the absorbance or integrated band intensities. Bands of known structural origin arising from either crystalline or

amorphous phases are studied to probe the structure basis and environment effect for each transition. Transitions are found around 50°K, 120°K, 180°K and 220°K for PET and around 50°K and 235°K for polystyrene.

\* Work supported by National Aeronautics and Space Administration.

**EK 10** Effect of Annealing and Antiplasticization on the Free Volume of Bisphenol-A Polycarbonate. R. E. ROBERTSON and CATHERINE W. JOYNSON, General Electric Co.--Annealing below the glass transition temperature and the addition of an antiplasticizer both seem to reduce the free volume of glassy polymers, as adduced from their tendencies to increase both the yield stress and the density. We have compared the combined effects of annealing and antiplasticization with the individual effects on the yield stress of bisphenol-A polycarbonate to see if annealing and antiplasticization are related, i.e., whether they both seem to operate on a common reservoir of free volume. We find that even under conditions where the individual effects tend toward saturation, the combined effects are still additive. This indicates that annealing and antiplasticization operate independently, suggesting that glassy polycarbonate, and probably other glassy polymers as well, has at least two separate reservoirs of free volume.

\*Present address: Ford Motor Company

**EK 11** The substructure of the cellulose microfibrils from the cell walls of the algae Valonia ventricosa. \* by K. H. GARDENER and J. BLACKWELL, Case Western Res. Univ.--The fine structure of the cellulose microfibril from the cell wall of the marine algae *Valonia ventricosa* has been investigated by observation of deformed and undeformed specimens in the electron microscope. On treatment with ultrasonic vibrations, the purified cell wall broke down into microfibrils 210Å in width. Sections of microfibrils which had been disrupted by the ultrasonic treatment consisted of elementary fibrillar fragments with a regular width of 35Å. Deformation by stretching on mylar film separated the microfibril into similar fibrils with a width of 35Å or multiples thereof. Striations on the intact microfibrils are interpreted in terms of a substructure consisting of these elementary fibrils.

\*Work supported by the National Science Foundation.

WEDNESDAY MORNING, 31 MARCH 1971

LORENZO CARTER—PICK-CARTER AT 9:00 A.M.

(R. L. MILLER presiding)

SYMPOSIUM OF THE DIVISION OF HIGH POLYMER PHYSICS IV B

Structure and Morphology I

Invited Papers

EL 1. Determination of Radial Distribution Function of Hard Sphere Fluid by X-Ray Small-Angle Scattering.  
G. W. BRADY, Bell Telephone Laboratories. (30 min)

EL 2. Direct Analysis of Small-Angle X-Ray Scattering from Fibrous Systems.  
P. J. HARGETT, Allied Chemical Corporation. (30 min)