Orientation Effects in Solid Polymers

The 5th Europhysics Conference on Macromolecular Physics in Budapest (27-30 April) was attended by about 175 participants including 50 from Hungary, 40 from other countries in Eastern Europe and 85 from Western Europe and the U.S.A.

The subject "Orientation Effects in Solid Polymers" appeared well chosen because it served as a link between experimentalists and theoreticians in various fields as well as between fundamental studies and their industrial applications. The main subject was divided into five topics:

I. Methods of Characterisation and Measurement of Molecular Orientation,
II. Mechanical and Physical Properties of Uni- and Biaxially Oriented Films,
III. Structure and Properties of Highly Oriented Fibers,
IV. Properties of Block Copolymers
V. Crystallisation Induced by Shear or Elongational Flow.

Although the relevance to technological properties formed the background and sometimes the foreground to some of the lectures, most of the studies reported in this conference were of a fundamental nature.

Under topic V., for instance, there were not only the beautiful experimental studies of Pennings, of Keller and of Yeh on Shear and Strain Induced Crystallisation, but also more theoretical papers by Ziabicki on the thermodynamics and on the mechanism of crystallisation.

Clearly, macromolecules offer promising possibilities for the study of the thermodynamics and kinetics of crystallisation in general and also for the production of crystals of very different, and sometimes exceptional, properties by suitable strain-temperature treatments.

In many respects polymer physics can be compared to solid state physics, both in the interaction between fundamental and applied science and in the fact that subtle structural changes induce large effects on measurable and technological properties.

Apart from 32 communications each of 15 minutes, for every topic there were one or more introductory papers which were generally of high quality.

Some of the main lectures (Ward, May, Yeh and Keller) and most of the short communications are printed in Volume I D of Europhysics Conference Abstracts.

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Quantum Electronics Approaching Maturity

The IXth International Quantum Electronics Conference held in Amsterdam, June 14-18, with which was associated a laser exhibition, was attended by 850 scientists ; 171 contributed, 49 invited and 46 post-deadline papers were presented. As was to be expected after more than 15 years of research in quantum electronics, a large number of papers were devoted to technical progress and refinements of existing methods and devices.

The whole visible and a good deal of the infra red and ultra violet spectrum is now covered by continuously tunable dye lasers and/or nonlinear-mixing processes. Except for the shortest wavelengths, radiation is available either as continuous wave at low and medium intensities (say < 1 W) or pulsed with intensities in the kW to MW range, ps to ns duration, and repetition rates of typically 1-100 s^{-1}. The short wavelength limit of coherent radiation has sucessfully been pushed down from previously 887 Å to 570 Å by means of frequency tripling of a Xe_2 laser. Considerable progress has been made in the ultra violet and vacuum ultra violet with noble gas-halogen mixtures, pumped with electron guns and electrical discharge excited noble gas halides. It has turned out, on the other hand, that lasing at X-ray frequencies is extremely difficult to achieve and will require further hard and sophisticated work.

Stable tunable lasers are now widely used for high-resolution spectroscopy and this has led in particular to a substantially broadened knowledge of the fine structure in the spectra of gases, improved time standards and fundamental constants (Rydberg frequency). A breakthrough in the spectroscopy of larger molecules may be expected in the near future.

Narrow-line high power gas lasers are able to excite selectively only one isotopic species of a gas which allows for the subsequent isotope separation of various elements. The dissociation of UF_6, which is of particular technical interest, requires radiation around 16 μm. Successful efforts have been made to find powerful lasers or nonlinear mixing schemes for this frequency.

The proven Nd : glass, CO_2, and iodine lasers have been further developed. Power levels of more than 1 TW have been achieved in a single amplifier chain of Nd : glass lasers. The construction of glass laser systems depositing 150-300 TW (100-200 kJ) on laser fusion targets is now being considered. Laser implosions with ion temperatures of 2keV, Lawson numbers of 10^{12} cm^3s and compression ratios of 10^2-10^3 have been achieved. Particular attention is now being paid to the interpretation of X-ray emission from laser plasmas (electron temperature, etc.) and neutron and ion yields (interaction parameters).

In nonlinear optics, exploitation of the enhancement of higher-order susceptibilities near a resonance has introduced a variety of new spectroscopy methods, and yielded numerous new data, for example natural lifetimes and dephasing times of selected excited states, transition probabilities for