Madras) discussed anomalous dispersion as a tool in structure determination, dealing with experimental and theoretical studies of phase determination based on deviation from Friedel's law. W. N. Lipscomb (Harvard) summarized the present knowledge of the structure of boron polyhedra and the complex chemistry of boron hydrides. A. I. Kitaigorodskii (Institute of Organic Compounds, Moscow) discussed the possibilities of calculating thermodynamic properties of crystalline compounds from structural data. N. V. Belov (Institute of Crystallography, Moscow), president-elect of IUC, spoke of new ideas of isomorphous replacement. Hugh E. Huxley (U. of Cambridge) discussed studies of biological systems by x-ray diffraction and electron microscopy.

Computers. A large number of crystal-structure determinations, increasing complexity of structures investigated and generally more precise results showed increasing use of fast computers. Proteins and other biological substances attracted much interest; 44 papers from almost as many laboratories dealt with protein crystal studies. Relatively few structures determined by direct methods were reported, but the number is clearly increasing rapidly.

At sessions on x-ray-diffraction theory interest centered on dynamical theory and anomalous transmission through perfect crystals (the Borrmann effect). Automatic single-crystal diffractometry was a major topic in sessions on apparatus and techniques. That crystallographers are concerned not only with rapid, automatic data collection but also with intensities was obvious; attendance at an open meeting on the subject of the Crystallographic Apparatus Commission had large attendance and lively discussion. Another well attended meeting discussed x-ray powder diffraction and the powder data file.

Scientific sessions were supplemented by an excellent book exhibit in a Moscow State University library, and an exhibition of apparatus and synthetic crystals. Unfortunately no American and few west European manufacturers were represented (apparently because of Soviet requirements that all apparatus displayed be sold or otherwise disposed of in the Soviet Union). Crystallographic equipment at the exhibit was unimpressive (with the exception of displays by one Dutch and one Japanese manufacturer). In contrast Soviet-built crystal-growing equipment and Soviet-grown synthetic crystals were impressive.

Benjamin Post
Polytechnic Institute of Brooklyn

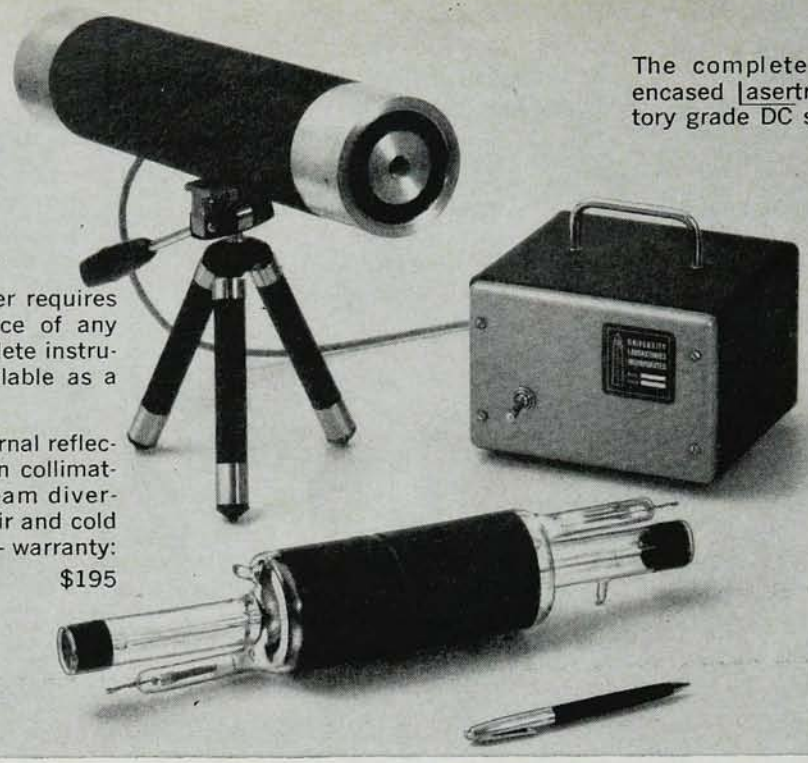
2. *Crystal growth in Moscow*

A symposium on crystal growth in Moscow followed the congress described in the preceding report. A session of invited papers was followed by parallel sessions on morphology, impurities, epitaxy and techniques.

At the plenary session P. Hartman (U. of Leiden) spoke on structure dependence of crystal morphology. He has extended the ideas of Gabrielle Donnay (Johns Hopkins) and David Harker (Roswell Park) and now classifies crystal faces by considering the uninterrupted strong-bond chain lying in the face. If a given chain (called the "periodic-bond chain," PBC) is linked to another PBC by strong bonds, this face will be important in the crystal if certain external factors are absent. With this and similar ideas one can make predictions about the morphology of a surprising variety of materials. Although the connection is at present obscure, the approach, if considered only for its ability to give rules applicable to the morphology of many materials, is arresting.

R. Kern (U. de Nancy) spoke on crystal growth in the presence of impurities, pointing out that morphological modification is not dependent on their incorporation into the crystal but only on their adsorption on growing faces. He showed that interpretations of habit modification can be based on thermodynamic, kinetic and crystal-chemical considerations.

G. I. Distler (Institute of Crystallography, Moscow) emphasized that electron microscopic examination of such materials as silicon, germanium, mica, quartz and sapphire shows various active centers usually associated with impurities. These active centers are thought to be essential determinants in many surface properties of solids such as reactivity and epitaxic overgrowth. On occasion blocking of



The complete laser contains an encased |asertron tube and a laboratory grade DC supply, line operated. $295

The |asertron™ tube never requires adjustment or maintenance of any kind. It is virtually a complete instrument in itself and is available as a separate unit.

It incorporates aligned internal reflectors and includes a built-in collimating lens for minimum beam divergence. The coaxial reservoir and cold cathodes insure long life — warranty: one year or 1000 hours. $195

NEW LASERS FROM UNIVERSITY LABORATORIES INC. from $195

The |asertron™ group: an entirely new line of continuous helium-neon gas lasers with these key achievements:

(1) The basic |asertron tube (patents pending) is a factory sealed unit which requires absolutely no alignment, adjustment, maintenance or special procedures to obtain full laser output. **It is as easy to use as an ordinary light bulb.** And, by virtue of its sealed construction and integral optics, it is ready for immediate operation in almost any environment—even under water!

The output wavelength is 6328Å (visible deep red); the tube automatically operates in the uniphase TEMoo mode and produces collimated, unpolarized output power of over .3 milliwatts. The tube has no filaments to burn out and has no shelf life limitations.

The |asertron tube is available as a separate item (ready to operate with your power supply) or installed in a complete ULI laser system.

(2) The complete ULI laser head incorporates the |asertron tube in a rugged machined housing provided with sturdy legs for table mounting. An accessory optical bench mounting rod is available as well as a very convenient tripod which telescopes for either floor or tabletop use.

The line operated supply provides the |asertron tube with regulated, filtered DC. There are no adjustments required for this supply, just the ON-OFF switch. The laser head and this supply are ideal for most research, educational or industrial gas laser applications. **The |asertron tube is warranted for one year or for 1000 hours of continuous operation when used with a ULI supply.**

|asertron Tube™ (ULI 220)	$195
Complete Laser with Line Operated Supply (ULI 230)	$295
Tripod	$ 16

UNIVERSITY LABORATORIES INCORPORATED

1740 University Avenue,
Berkeley, California 94703
Phone: (415) 848-0491

☐ Please send technical data on the ULI lasers.

☐ Please reserve ( ) |asertron™ tube $195
( ) Complete laser system . . . $295

from your current production. My official purchase order and shipping instructions will follow.

Name_____

Organization_____

Address_____

City_____ State_____ Zip_____

Terms are 2% discount 10 days, net 30 days. ULI products returned for any reason, prepaid and undamaged within 30 days, will receive full credit.

an active center by, for instance, an adsorbed impurity, can be of overriding importance in determining surface behavior.

In one of the contributed papers A. A. Chernov (Institute of Crystallography, Moscow) talked on crystallization theory for a binary system. His work illustrates the efficacy of using an essentially statistical approach to the growth process. Good progress has been made in the analysis of idealized binary chain systems by this approach, and presently there is optimism among workers in crystal-growth theory that it will yield results on more complex systems.

R. A. Laudise
Bell Telephone Laboratories

3. Crystal growth in Boston

To bring experimentalists and theorists together was one of the aims of last June's International Conference on Crystal Growth in Boston. Papers covered melt growth (38 papers), vapor growth (26), solution growth (20), flux growth (17), surfaces (10), interface kinetics (10), shape stability (9), crystal perfection (9), hydrothermal and high-pressure growth (9), epitaxial growth (9) and segregation and convection (8).

Shape stability. Considerable attention went to the currently active subject of morphological (shape) stability. R. F. Sekerka (Westinghouse) originator with W. W. Mullins (Carnegie Tech) of concepts responsible for present activity in the field, presented a time-dependent theory of dilute binary alloy stability for planar interfaces. He arrives at a stability criterion identical to that of the steady-state approximation. J. W. Cahn (MIT), S. R. Coriell (NBS) and I dealt with stability enhancement of a sphere that is caused by interface kinetics and showed that this can be a large effect.

Among papers on molecular mechanisms and transport was one by D. W. James (Westinghouse), who has determined the basal-plane growth kinetics of ice for interface coolings between 10^{-4} and 10^{-2}°C using the new thermal-wave techniques of Kramer and Tiller. K. A. Jackson and J. D. Hunt (Bell Labs) with some remarkable motion pictures showed freezing of certain transparent organic materials that, according to a Jackson theory, solidify like metals. The movies permitted direct observation of growing cells and dendrites and eutectic growth. P. Bennema (U. of Groningen) has made careful measurements of growth rate as a function of supersaturation in sodium-chlorate solution and finds general agreement with the surface diffusion model of W. K. Burton, Nicholas Cabrera and F. C. Frank. J. A. Simmons (NBS) and his colleagues presented an exact computer solution of the difficult nonlinear Stefan moving-boundary problem for vapor-phase growth of whiskers.

In another newly emerging field, influence of thermally induced liquid convection in growth from melt, H. P. Utech (NBS) and M. C. Flemings (MIT) showed experimentally how motion of conducting liquids (metals and semiconductors) can be conveniently controlled or stopped by dc magnetic fields. The solute-banding problem they demonstrated, is caused by turbulent thermal convection and can be eliminated with a magnetic field during growth.

Nucleation. H. Bethge (East German Academy of Sciences) and A. E. Nielsen (U. of Copenhagen) reported studies of nucleation phenomena. Bethge showed beautiful electron micrographs of monatomic disk-shaped hole nuclei formed by evaporation of sodium-chloride cleavage surfaces. Nielsen has studied nucleation of calcium tungstate and other materials from water solution; he finds that homogeneous nucleation occurs and is followed by diffusion-controlled growth.

Among new studies on perfection of crystals F. W. Young (Oak Ridge) has looked at dislocations by Borrmann topography and by etch pits in nearly perfect melt grown copper crystals (as small a dislocation density as $50/cm^2$). He find a one-to-one correlation between x-ray images and dislocation etch pits. B. Nöst, G. Sörensen and E. Nes (U. of Oslo) showed, also by topographic techniques, that in very pure aluminum crystals grown by strain-anneal techniques, dislocation density always increases with cooling from 370 to 270°C and nearly always with heating from 270 to 370°C;