the Prague Semiconductor Conference. Since this type of ionization can be compared with secondary emission and multiplication in that the energy of the ionizing carrier must be large enough to enable the new carrier pairs to create more pairs, previous approaches assumed that, as in a Townsend discharge, this energy must be twice the known 1.1 ev energy gap (for silicon). Shockley proposed instead a statistical mechanism involving the acoustical lattice modes (the Raman frequency for silicon corresponding to 0.06 ev) and an assumed mean free path of the ionizing carrier of 50 angstrom units.

A session on epitaxial growth in semiconductors followed, and Bell Laboratories Vice President Morton, who chaired the session, referred to the process as one equal in importance to the diffusion process. Ian Ross, director of semiconductor development at Bell Laboratories, described one form of epitaxial transistor which operates at exceptionally high frequencies through a reduction in the adverse effect of stored carriers. In this unit the number of such carriers is reduced and the lower collector resistance shortens the time needed for removal of these carriers. Ross' photos of layers grown epitaxially on seed crystals showed remarkable smoothness. Ralph Ruth of the Bendix Laboratories showed many photographs of single-crystal vapor-deposited layers of germanium. He discussed the dependence of growth rate of the deposition layer on the orientation of the seed crystal and pointed out that growth was more rapid when the (110) orientation was used. One photograph of a cross section of a crystal and its grown layer showed the extreme uniformity of both the seed crystal and the grown layer in the vicinity of the junction. Dr. Ross had earlier indicated that with interference methods he had been able to ascertain that his grown layers were as smooth as the original seed surface. When questioned regarding the requirements for a lattice match between substrate and deposited material, Dr. Ruth described a vapor-deposited layer of germanium which he had grown on a seed crystal of gallium arsenide. Dr. Ross also expressed the opinion that a close lattice match would not prove to be essential to the epitaxial process.

At a session chaired by David Dennison, chairman of the Physics Department of the University of Michigan, D. C. Cronemeyer of the Bendix Laboratories presented a discussion of the problem of the deep states in semiconductors. He observed that the only theory available today predicts energies of a few hundredths of an electron volt for hydrogen-like impurities in semiconductors. These shallow states are in general observed experimentally; on the other hand there are many impurities which engender deep states (high ionization energies) in germanium and silicon. Since these states can act as recombination centers, improved infrared detectors have resulted through the addition of unusual dopants (such as gold and zinc) to germanium. Cronemeyer mentioned that the aid of W. Thirring of the University of Vienna has been enlisted for a theoretical attack on the problem of the deep states. He emphasized the need for more experimental data on the effects

Rudolph Mössbauer and N. R. Nelson.

caused by the introduction of various impurities not yet tried. Chihiro Kikuchi of the University of Michigan discussed certain aspects of stimulated emission devices, concentrating on a consideration of the transitions available and those required for the most efficient operation of a maser. W. C. Wiley of Bendix concluded the session with a discussion of recent developments in electron multiplication techniques. Participants in a final round-table discussion included Goudsmit (Brookhaven), Martin Stearns (Wayne U.), Henry Gomberg and Joseph Boyd (U. of Michigan), Urner Liddell (ARPA), Col. E. C. Mallary (WADD), and Capt. N. R. Nelson (BuShips).

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Electron Beams

THE third annual Symposium on Electron Beam Technology, organized under the auspices of Alloyd Electronics Corporation, will be held March 23–24 in Boston. The program will cover the following topics: (1) electron beam physics; (2) welding and refining; (3) applications of electron beams for advanced techniques such as polymerization, food processing, etc.; and (4) the present and future applications of electron beams to microelectronics. For detailed information, contact the symposium chairman, R. Bakish, 37 Cambridge Parkway, Cambridge 42, Mass.

Scientific and Engineering Education

DURING the observance of its 100th anniversary, Massachusetts Institute of Technology will hold an International Conference on Problems of Scientific and Engineering Education (April 3–6), in which 100 prominent scholars in the arts and sciences from all over the world will participate. On April 7, a plenary session will follow with internationally known speakers and a summary of the previous three days' discussions. Public panel discussions on "The Future in Arts and Sciences" and "Some Problems of Contemporary Society Posed by Science and Technology" will take place on Saturday, April 8.

Inter-Society Color Council

THE 30th Annual Meeting of the Inter-Society Color Council will be held April 10–12 at the Sheraton Hotel, Rochester, N. Y. The program will include meetings of the color problems subcommittees,