Picosecond electronics and optoelectronics

O. P. Zaskal'ko

Usp. Fiz. Nauk **151**, 732–733 (April 1987)

Picosecond Electronics and Optoelectronics. Eds. G. A. Mourou, D. M. Bloom and C. H. Lee. Springer-Verlag, Berlin; Heidelberg; New York; Tokyo, 1985, pp. 258 (Springer Series in Electrophysics, V. 21).

The book being reviewed is the 21st volume of "Springer Series in Electrophysics." The book is based on the material of a conference of the American Optical Society which took place at Lake Tahoe, Nevada in March 1985. The book includes both review and original articles, a total of approximately 50, the content of which reflects the present-day state in a number of divisions of picosecond optics, optoelectronics and semiconductor electronics. The whole material of the book is divided into six sections. We shall quote the titles of the sections indicating in parentheses the number of articles contained in each of them: 1. Ultrafast optics and electronics (13). 2. Highspeed phenomena in bulk semiconductors (6). 3. Quantum structures and applications (9). 4. Picosecond diode lasers (4). 5. Optoelectronics and switching of photoconductivity (14). 6. Cryoelectronics (5).

The majority of the articles of the first and second sections of the book are devoted to the investigation of phyical processes occurring in semiconductors and specific semiconducting devices—transport of charge carriers, electron-phonon and exciton-exciton interaction, photoconductivity. The emphasis is placed on optical methods of investigation, utilizing for diagnostics sequences of ultrashort, picosecond and subpicosecond light pulses. The point is that the time resolution of optical methods is higher by several orders of magnitude than that of all others. Dye lasers can generate continuous sequences of pulses whose duration after compression at present attains values of 8 femtoseconds.

Great advances in the technology of preparing crystalline semiconductors have been achieved during the last 10 years. This is primarily associated with the development of the technique of heteroepitaxy due to which an entire class of new fast-acting electronic and optical devices based on GaAs has appeared. The latest achievements of the new methods of heteroepitaxy such as metalorganical chemical gas-phase deposition, epitaxy by molecular beams, are reflected in the articles of the third section of the collection.

Optics is represented in the book not only as a method of measurement. A number of articles discuss the possibility of controlling the work of electronic circuits by laser radiation, and sections 4 and 5 are entirely devoted respectively to semiconducting lasers with mode locking, and electro-optical switches and photoreceivers operating in the picosecond range. The explanation for this is the important role which they play in systems of fiber optics communication.

The last sixth section of the book includes articles referring to the field of cryogenic electronics where interesting results have been obtained in rapid analysis of signals.

Aerogels

B. M. Smirnov

Usp. Fiz. Nauk **151**, 733–734 (April 1987)

Aerogels. Ed. J. Fricke, Springer-Verlag, Berlin; Heidelberg; New York; Tokyo, 1986, pp. 205 (Springer Proceedings in Physics, V. 6)

Sols are individual particles in a liquid or gaseous phase, gels are systems of coupled sols. Aerogels are light structures formed of individual particles. The reality of the existence of such structures has been understood in recent years, and the present book is a collection of the proceedings of the First International Symposium on Aerogels which took place in September 1985 in the Federal Republic of Germany.

The interest in aerogels is along two directions. First, they are unique physical objects with specific properties. The principal part of the articles of the book is devoted to the properties of aerogels. Secondly, the special properties of aerogels enable finding a number of possibilities of utilizing them for applied purposes. A significant part of the articles in the book is devoted to the applied aspects of the problem.

The aerogels under discussion are in their chemical composition SiO_2 with a number of water molecules. The molecules of silicon dioxide can be replaced in an aerogel by other oxides Al_2O_3, ZrO_2, $M_g O$, MoO_2, Fe_3O_4, TiO_2, Li_2O, B_2O_3, etc. However, silicagel—an aerogel based on silicon dioxide—constitutes the principal part of the investigations. The size of the particles in an aerogel varies approximately from 3 to 60 nm depending on the conditions under which it was obtained. The aerogel itself has the structure of a fractal cluster [cf.: Usp. Fiz. Nauk **149**, 177 (1986); Sov. Phys. Usp. **29**, 481 (1986)], i.e., the particles are joined in it according to random law, and the density of matter in such a cluster is the lower the greater is its size. Formation of an

 0038-5670/87/040350-02$01.80