Fiber optics of fluoride glasses

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Fluoride Glass Fiber Optics, **(Eds.) I. Aggarwall and G. Lu**, Academic Press, Boston, San Diego, New York, London, Sydney, Tokyo, Toronto, 1991, p. 401.

The monograph "Fluoride Glass Fiber Optics" consisting of a collection of articles edited by I. D. Aggarwall and G. Lu summarizes and generalizes the world achievements in the field of the technology of preparation, of the analysis of physico-chemical properties and of application of fluoride glasses. Leading specialists from Great Britain, USA, France and Japan who are authors of pioneering work in the above field participated in writing the book.

The optics of fluoride glasses has been intensively developing over a period of fifteen years first of all due to the real promise of exciting technical applications. They are based on the unique transparency of fluoride glasses in the near and medium IR range. According to theoretical estimates the amount of optical losses at a radiation wavelength of 2.5 μm can be reduced to the level of 10^{-2} dB/km, and the practically attained value is 0.025 db/km. This enables one to pose seriously the question of producing transoceanic lines of fiber optic communications without intermediate repeaters or amplifiers. Among other applications we mention medicine, IR spectroscopy, supersensitive fiber sensing units for different physical quantities. Active light guides, doped by ions of rare earth metals, are being used successfully for amplifying ultrashort optical pulses and the construction of fiber lasers.

We briefly describe the structure and contents of the book. The first part is devoted to the fundamental aspects of the physics and technology of preparing fluoride glasses. In the first chapter M. Poulain provides a detailed classification of fluoride glasses prepared up to the present time and examines the processes for their manufacture. The second chapter deals with theoretical and experimental investigations aimed at analyzing the microscopic structure of glasses, basically applied to simple binary systems of the ZrF–BaF_2 type. Then, in the third chapter, a detailed discussion is given of the physical mechanisms of optical losses in a wide band of optical frequencies from UV to the IR range. Particular emphasis is made on bringing out factors that determine the short wave and the long wave boundaries of the band of transparency.

Subsequent chapters are devoted to problems directly associated with the technology of preparation of fiber light guides with extremely low optical losses. At first methods are described of the purification and analysis of initial materials. This is followed by a comparative analysis of the technology of preparation of blanks and of drawing out fiber light guides and, finally, a discussion is given of the sources of losses in light guides.

In the second part of the book a discussion is given of the chemical stability of fluoride light guides, of methods of protecting them from corrosion and unfavorable external influences. For many applications, radiation resistance plays an important role, and this is the subject of the eighth chapter. We note that in fluoride glasses it is in a number of cases significantly better than in quartz glasses. The concluding chapter discusses properties and applications of active light guides.

The book is excellently illustrated and contains extensive experimental material and a well selected bibliography. It can be confidently recommended to all specialists working in the field of fiber optics.

Translated by G. M. Volkoff

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