Invited Paper

Kinetics of photoinduced absorption in chalcogenide glass fibres.

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ABSTRACT

Experimental and theoretical results are presented for the kinetics of photoinduced absorption in chalcogenide glass fibres. Photoinduced absorption measurements were carried out both at room temperature as well as at liquid nitrogen temperature in a wide range of probing light photon energy $\hbar\omega < E_g$.

Experimental results are interpreted on the bases of the model with quasicontinuous distribution of localized states in the gap. Both experimental and theoretical results show that subbandgap light can not only reduce the previously induced absorption but can produce an enhancement of photoinduced absorption also.

It is shown, that photoinduced absorption data can be used for determining the parameters of localized states distribution. Computer simulation of photoinduced absorption kinetics shows a good correlation with experimental results.

1. INTRODUCTION

One of the main components of the modern telecommunication systems are optical fibres made from silica and silica-based glasses. Optical losses of such fibres are very low and at present a value of 0.2 dB/km is reached. The IR optical materials promise a greater transparencies than those feasible with silica fibres. At the same time application of IR optical fibres presents a great interest for other fields of industry. IR fibres are fabricated from some crystals and numerous glasses, such as heavy-metal fluoride glasses and chalcogenide glasses.

As it was founded out the chalcogenide glasses have a number of advantages in comparison with other materials. For example, they are transparent in a wide spectral range which spreads up to 14 μm, they are convenient from technological point of view, have good acousto-optical properties, and their index of refraction can be modified by means of optical irradiation, etc.

The main problems of the chalcogenide glass fibres are optical losses which are limited by three factors: the electronic absorption, the vibrational absorption, and the Rayleigh scattering. The electronic absorption in chalcogenide glasses is determined by the optical interband transitions, or by the optical transitions from localized states in the gap to extended states and vice versa.

While the chalcogenide glass sample is excited by the light with photon energy $\hbar\omega > E_g$, the nonequilibrium carriers which appear in the free bands are very quickly captured in the localized states and gives rise to photoinduced absorption (PA) at the energies $\hbar\omega < E_g$.

We have investigated the kinetics of PA in chalcogenide glasses induced by bandgap illumination as well as the kinetics of trapped carriers activation and their redistribution on localized states in the gap.

0-8194-1813-7/95/$6.00