Researchers prepare radiation resistance of Er-doped silica glass and optical fiber

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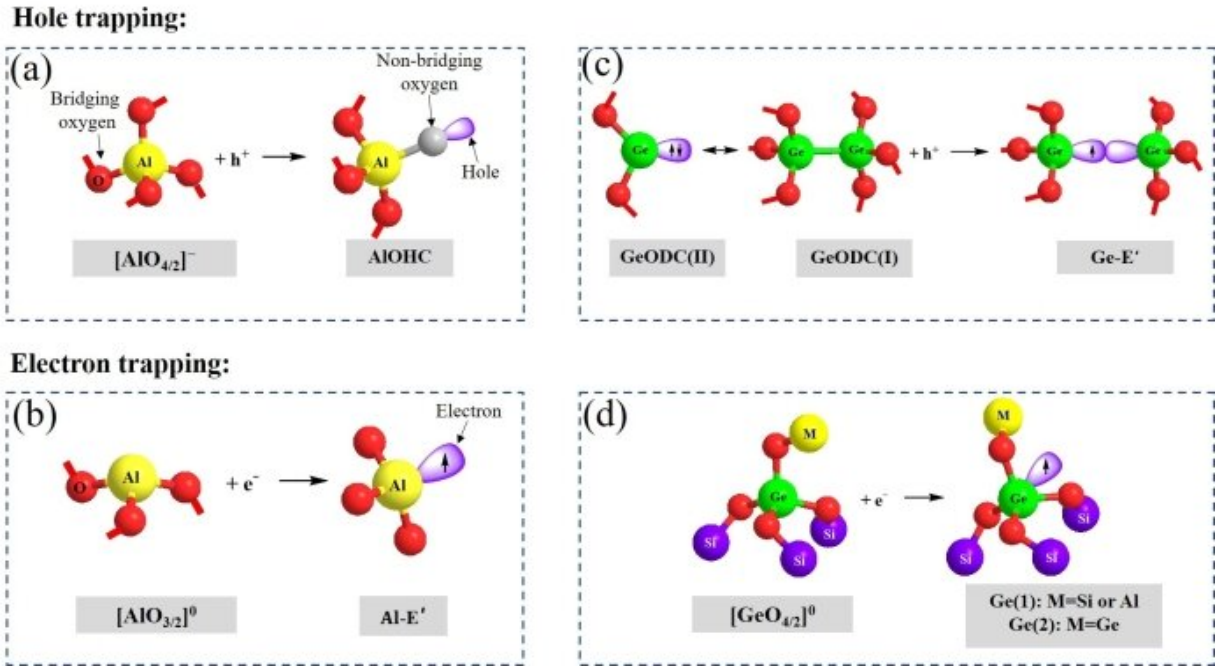

Model for the formation of the Al- and Ge-related defects caused by radiation. Credit: SIOM

Rare earth-doped active fibers are crucial in space-based applications, such as space laser communication, laser radar, and space waste disposal. However, the space radiation environment can lead to a sharp increase in the optical loss of rare earth-doped active fibers, and a sharp decrease in the output laser slope efficiency or gain performance. Therefore, it is

very important to improve the radiation-resistance property of rare earth-doped silica fiber.

Recently, a research team from the Shanghai Institute of Optics and Fine Mechanics of the Chinese Academy of Sciences has prepared a radiation -resistant Er (erbium)-doped silica glass and optical fiber by co-doping with germanium (Ge) ions. they also investigated the related radiation resistance mechanism. The results have been published in *Optical Materials Express* on June 3 and selected as Editor's pick.

In this work, the researchers briefly introduced the space radiation environment of the application requirements, and the challenges of active fibers in space.

The researchers prepared Ge ion co-doped silica glasses and fibers, and the radiation induced color centers were identified by induced absorption and electron paramagnetic resonance spectroscopy. Then they proposed the formation and conversion process of aluminum (Al) and Ge-related color centers and the radiation-resistance mechanism of Ge co-doping.

The results of online X-ray radiation experiments show that Ge co-doping can significantly improve the gain performance of Er-doped fiber amplifier (EDFA) after radiation.

This work provides a necessary reference for the optimization and design of radiation hardening Er-doped silica fiber core glass composition for future space EDFA applications.

More information: Yan Jiao et al, Effect of the GeO_2 content on the radiation resistance of Er_3^+ -doped silica glasses and fibers, *Optical Materials Express* (2021). DOI: 10.1364/OME.425197

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