# Spectral-luminescent properties of silver ion-exchanged aluminosilicate glass doped with Eu3+ ions

Yevgeniy Sgibnev*[1], Benjamin Asamoah[1], Dmitriy Marasanov[1], and Nikolay Nikonorov[1]

[1]ITMO University [Russia] – 49 Kronverksky Pr., St. Petersburg, 197101, Russia

**Abstract**

Nowadays, silver nanostructures are of great interest for many applications of photonics due to their unique optical, non-linear and electrical properties. Silver clusters (SCs) in glass well-known to possess intense and broadband luminescence in the visible. Glasses with luminescent SCs were proposed to be used as phosphors for white LEDs, down-shifting glasses for solar cells and optical data storage media. On the other hand, well-known rare earth ions are characterized by narrow and weak absorption bands. Energy transfer from SCs can be used for improving characteristics of optical glasses doped with rare earth ions.
Glasses based on the Na2O–Al2O3–ZnO–SiO2–F system doped with Sb2O3 (0.002% mol.) and Eu2O3 (0-0.5% mol.) were synthesized. Silver ions were incorporated into the glass by ion exchange (IE) diffusion. In order to form SCs the ion-exchanged samples were heat-treated at temperatures in the range of 350-500∘C. In this work we presents results on study of influence ion-exchange duration, heat treatment temperature and duration on the energy transfer from SCs to Eu3+ ions.

As-prepared samples show no luminescence under UV excitation at 350 nm. Broadband and intense luminescence related to SCs are observed in the glass after the IE and subsequent heat treatment. Intensity of SCs luminescence, as well as Eu3+ ions emission, increases with rising the (HT) temperature from 350 to 450 ∘C. Moreover, intensity of the Eu3+ emission in the glasses after formation of SCs is much higher than that in the as-prepared glasses due to energy transfer from SCs to Eu3+ ions. Formation of silver nanoparticles, which are characterized by the surface plasmon resonance, in the ion-exchanged glass samples heat-treated at 500 ∘C results in luminescence quenching.

Thus, we observed effective energy transfer from SCs to Eu3+ ions in silver ion-exchanges aluminosilicate glass. The developed glass can be used as down-convertors for solar cells and phosphors for LEDs.
This work was supported by the Ministry of Education and Science of Russian Federation (Project 16.1651.2017/4.6).

**Keywords:** silver clusters, europium, silicate glass, ion exchange, luminescence

*Speaker