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# Enhanced and wavelength-tunable near-infrared luminescence from bismuth-doped silica thin films with Au nanocrystals

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## ABSTRCT

Near-infrared (NIR) luminescence origin of Bi-doped amorphous silica thin film is elucidated by the XPS characterizations and selective photoluminescence (PL) measurements. The excitation wavelength-dependent NIR luminescence suggests the co-existence of two different types of Bi-related active centers, $Bi^0$ and $Bi^+$, should contribute to the NIR PL emissions at 1150 nm and 1280 nm, respectively. A confined crystallization growth strategy is designed for fabricating the uniform-size Au nanocrystals (NCs) embedded in Bi-doped amorphous silica thin film. Via controls of the doping amounts of Au ions, the NIR PL emission of Bi ions in amorphous silica thin film can be wavelength-tunable and enhanced by nearly 300% on the optimum Au ions doping amount. Temperature-dependent PL emission spectra demonstrate parts of Au ions play a role of eliminating hydroxyl groups and give rise to greatly enhanced NIR PL emission intensity. We anticipate that both the greatly enhanced and wavelength-tunable PL emission and the discussion of NIR luminescence origin will shed light on future research of Bi-doped luminescent materials.

**Keywords:** Thin films; Silica; Near-infrared luminescence; Sol-gel preparation