Distribution of Bismuth and Bismuth-Related Centers in Core Area of Y-Al-SiO2:Bi Fibers

Alexander V. Kir'yanov, Member, IEEE, Senior Member, OSA, Arindam Halder, Yuri O. Barmenkov, Member, IEEE, Shyamal Das, Anirban Dhar, Shyamal K. Bhadra, Vassily V. Koltashev, Victor G. Plotnichenko,and Mukul C. Paul, Member, IEEE, Member, OSA

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Abstract

Analysis of the experimental data on microscopic, absorptive, fluorescent, and Raman-scattering properties of Bismuth (Bi)-doped yttria-alumino-silicate glass (Y-Al-SiO2 :Bi)-based nanoengineered optical fibers, exhibiting broadband near-infrared fluorescence, is presented. Among the other well-established characteristics, inherent to Bi-doped silica fibers codoped with Aluminum (Al), a trend of spatial distributions of Bi atoms and Bi-related fluorescence-active centers is determined, being their concentrating in ring-like areas around the core's center, at approximately a half-distance to core/cladding interface. At the same time, the formation in this region of nanosized Bi clusters, supposedly weakly or nonfluorescing, is revealed for the fibers. These phenomena are argued to underlie worsening of the pump-to-signal overlap factor, which deteriorates efficiency of lasers and amplifiers based on such or similar Bi-doped alumino-silicate fibers.