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Size effect in self-trapped exciton photoluminescence from SiO2-based nanoscale materials YURI GLINKA, Vanderbilt University — Direct evidence for a size effect in self-trapped exciton (STE) photoluminescence (PL) from SiO_2-based nanoscale materials as compared to bulk type-III fused silica is obtained. The PL was induced by the two-photon absorption of focused 6.4 eV ArF laser light with intensity $\sim 10^6$ Wcm^{-2} and measured in a time-resolved detection mode. Two models are applied to examine the blue shift of the STEPL band with decreasing size of nanometer-sized silica fragments. The first model is based on the quantum confinement effect on Mott-Wannier-type excitons developed for semiconductor nanoscale materials, which is completely unusable in the case of wide-band-gap nanoscale materials. The second model takes into account the laser heating of carriers due to collisions with the boundary of nanometer-sized silica fragments in the presence of an intense laser field. The laser heating of carriers in excess of the activation energy for the exciton self-trapping give rise to the extremely hot STE's. As a result, the blue shift of the STEPL band is originated from the activation of hot (phonon-assisted) electronic transitions.

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