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Precise regulation of Bismuth Active Centres in alkaline earth ions-doped Ga_2O_3-GeO_2 glasses by Bi-Al pre-combination

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Supplementary Figure

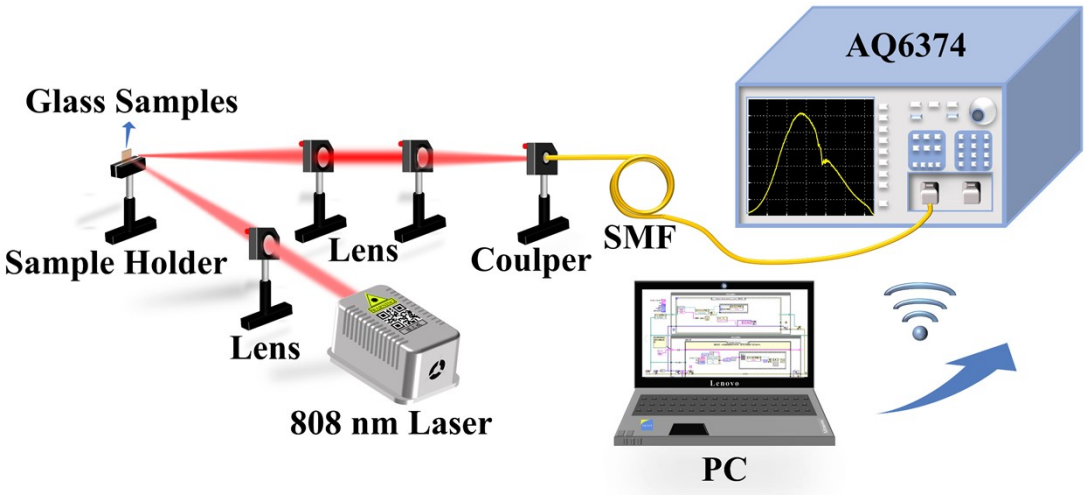

Fig. S1 Diagram of the device for measuring photostability at room temperature.

Supplementary Texts

Text. S1 Description of the photostability measurement process.

As shown in Fig. S1, the pump light emitted from the 808 nm semiconductor laser (operating at a current of 2A, corresponding to an output power of 1W) was focused onto the glass sample fixed by a sample holder via a lens. The NIR luminescence from the sample passed through a 4F optical system (comprising two lenses) and was focused into an optical coupler, then connected to an optical spectrum analyzer (AQ6374) via a single-mode fiber (SMF). The PC sent instructions to the AQ6374 via WiFi to record the spectra at specified intervals, thereby measuring the photostability of glass samples. Critically, during the measurement process, both the glass samples and all equipment were placed inside a dark box made of black plastic panels to effectively eliminate the interference of stray light.

Text. S2 Discussion of mechanism behind the difference in fluorescence lifetime between samples CaxA and CaxB.

The emission spectra shown in Figure 2(a-b) indicate that when the Bi content is between 0.1-3.0 mol%, the emission intensity of sample CaxA is slightly higher than that of sample CaxB. This is because the number of BACs in sample CaxA is greater than that in sample CaxB, resulting in stronger interactions between BACs in sample CaxA compared to sample CaxB. This leads to a longer lifetime in sample CaxB than in CaxA. When the Bi content reaches 5.0 mol%, sample Ca5.0A undergoes concentration quenching, enhancing the interaction between BACs and Bi clusters, which accelerates fluorescence lifetime decay. Meanwhile, the emission of sample Ca5.0B continues to increase, almost doubling, so its lifetime remains longer than that of sample Ca5.0A.