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Scintillation, dosimeter and optical properties of MgF_2 transparent ceramics doped with Gd^{3+}

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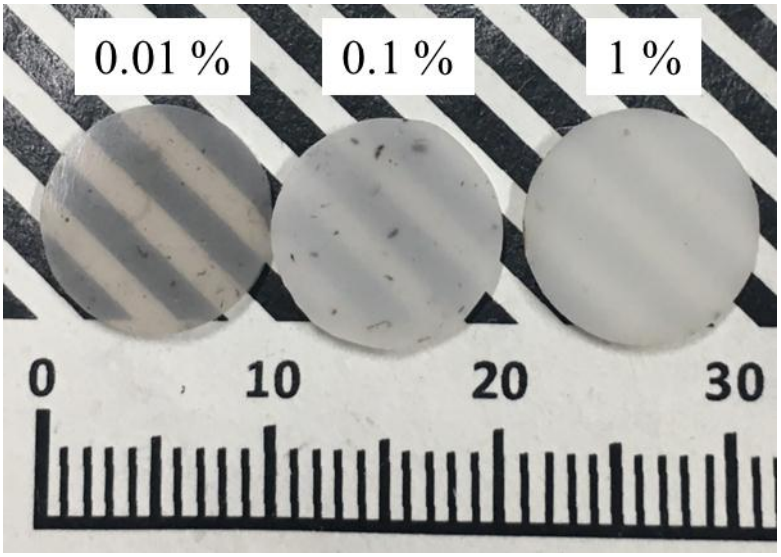
Graphical abstract



Highlights

- We have developed MgF_2:Gd^{3+} transparent ceramics by SPS.
- The samples showed luminescence due to the 4f-4f transitions of Gd^{3+}.
- The 1% Gd-doped sample has high TSL sensitivity equivalent to commercial personal dosimeters.

Abstract: In this study, we have developed MgF_2:Gd transparent ceramics by spark plasma sintering (SPS) and evaluated the scintillation, dosimeter and optical properties. All the sample were successfully synthesized in a transparent form with relative densities over 99 % to that of the single crystal. The samples were confirmed to show scintillation, thermally-stimulated luminescence (TSL) and optically-stimulated luminescence (OSL). The origin of these emissions was due to the 4f-4f transitions of Gd^{3+} appearing as a single peak at 310 nm. In particular, the TSL was very sensitive to X-rays, and especially the 1 % Gd-doped sample showed a sensitivity as low as 0.1 mGy. The TSL response increases