Thickness dependence of persistent luminescent thin films

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Luminescent materials critically influence advanced photonic technologies and global applications, particularly in persistent luminescence devices for enhanced performance and high energy storage efficiency. Considering the role of thin films in the industry as the higher area of uniform monolithic and dense materials (Fig.1a), it's important to develop new routes to produce persistent luminescence (PersL) systems, one of the most important photonic materials on energy storage, signaling, and solar cells fields.[1] In this work, the $Sr_2MgSi_2O_7:Eu^{2+},Dy^{3+}$ (SMSO) was synthesized via the co-precipitation method followed by thermal annealing using the microwave-assisted solid-state method (MASS), aiming to obtain a purest and most efficient PersL powder material. The particulate was milled for 12 hours and dispersed in an ethylcellulose/terpineol medium to prepare a homogeneous and stable suspension, which was then used for depositing thin films of varying thicknesses on 10x10 mm Si(100) substrates via spin-coating.[2] The thin films were heated at 400 °C for 3 h to eliminate the organic phase from the final sample. The interface between the substrate and PersL thin film with around 10 µm thick shows a significant adhesion when observed by SEM cross-sectional fracture profile (Fig.1b). The luminescence spectrum of the thin film shows a high emission broadband, centered at 485 nm, assigned to the transition $4f^6 5d^1 \rightarrow 4f^7$ of Eu^{2+} (Fig.1c). Thus, we have demonstrated the viability of producing ceramic thin films of varying thicknesses that exhibit persistent luminescence emission in the blue region of the spectrum.

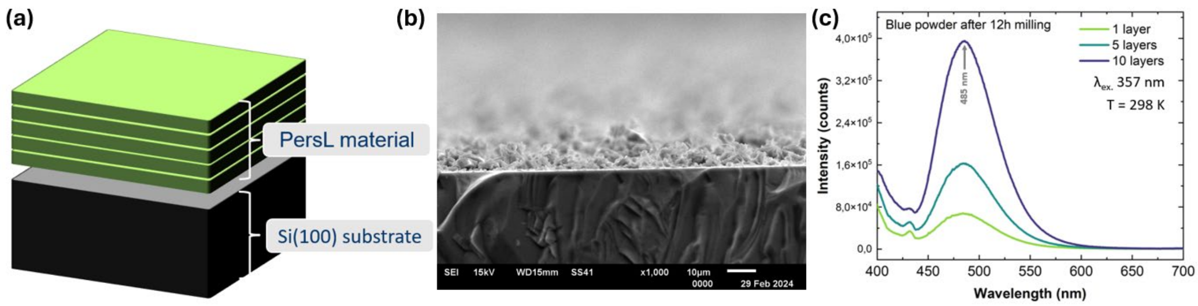

Figure 1 – Scheme of thin film deposition on Si(100) substrate (a), SEM cross-section view of the pristine 5-layers sample, and (c) emission spectra of samples with 1, 5 and 10 deposited SMSO layers (λ_{ex} 357 nm).

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