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# Design of hierarchical composite silicate for full-color and high thermal stability phosphors

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**ABSTRACT:** Design of new hollow structure materials with high complexity in shell architecture and composition has been proven to be an efficient strategy to improve their properties in many applications. Herein we devise and demonstrate a general strategy to synthesize composite silicate with hierarchical hollow structure: (1) coating mesoporous silica on precursor; then (2) treated with proper solution on certain conditions, and then (3) thermal treatments. By using $Y(OH)CO_3$ submicrospheres as precursor, hollow composite silicate ($Y_2Si_2O_7@Zn_2SiO_4$) has been fabricated successfully. This $Y_2Si_2O_7@Zn_2SiO_4$ structure can accommodate multifold luminescent activator ions ($Ce^{3+}$, $Mn^{2+}$, $Eu^{3+}$) and realize full-color luminescence under a single wavelength excitation. Moreover, the emission of $Ce^{3+}$,