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Preparation of the cerium silicate thin films by solid phase reaction of CeO_2 and Si

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Cerium silicate ($\text{Ce}_2\text{Si}_2\text{O}_7$) is a promising material for optical applications such as EL and LED devices. Optical band gap of $\text{Ce}_2\text{Si}_2\text{O}_7$ is approximately 3.4-3.5 eV, which is comparable to that of ZnO or GaN. The reports on $\text{Ce}_2\text{Si}_2\text{O}_7$, however, is rare due to the difficulty in the synthetic process of the material.

$\text{Ce}_2\text{Si}_2\text{O}_7$ is prepared by a solid phase reaction of the samples having $\text{CeO}_2/\text{Si}(100)$ structure. CeO_2 films were deposited on p-type Si (100) substrates by metal-organic chemical vapor deposition (MOCVD) technique in the temperature range from 500°C to 900°C using $\text{Ce}(\text{tmhd})_4$. And then the films were annealed at 1100-1200 °C in vacuum or in oxygen atmosphere, resulting in the evolution of $\text{Ce}_2\text{Si}_2\text{O}_7$ phase.

Compositional, chemical, structural, and optical properties of the $\text{Ce}_2\text{Si}_2\text{O}_7$ thin films were investigated by scanning electron microscopy (SEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and photoluminescence (PL) measurement. Strong UV emission near 375-385nm was observed from the $\text{Ce}_2\text{Si}_2\text{O}_7$ thin film annealed at 1100 °C.