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Effects of Ca content on formation and photoluminescence properties of $CaAlSiN_3:Eu^{2+}$ phosphor by combustion synthesis

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Effects of Ca content (in the reactant mixture) on the formation and the photoluminescence properties of $CaAlSiN_3:Eu^{2+}$ phosphor (CASIN) were investigated by a combustion synthesis method. Ca, Al, Si, Eu_2O_3, NaN_3, NH_4Cl and Si_3N_4 powders were used as the starting materials and they were mixed and pressed into a compact which was then wrapped up with an igniting agent (i.e., $Mg+Fe_3O_4$). The compact was ignited by electrical heating under a N_2 pressure of ≤1.0 MPa. By keeping the molar ratios of Al and Si (including the Si powder and the Si in Si_3N_4 powder) both at 1.00 and that of Eu_2O_3 at 0.02; XRD coupled with TEM-EDS and SAED measurements show that $AlN:Eu^{2+}$ and Ca-α-$SiAlON:Eu^{2+}$ are formed as the major phosphor products when the Ca molar ratio (denoted by Y) is equal to 0.25 and $AlN:Eu^{2+}$ and Ca-α-$SiAlON:Eu^{2+}$ could not be detected at Y≥0.75 and ≥1.00, respectively. CASIN (i.e., CaAlSiN3:Eu^{2+}) becomes the only phosphor product as Y is increased to 1.00 and higher. The extent of formation of CASIN increases with increasing Y up to 1.50 and begins to decrease as Y is further increased to 1.68. While the excitation wavelength regions are similar at various Y, the emission wavelength regions vary significantly as Y is increased from 0.25 to 1.00 due to different combinations of phosphor phases formed at different Y. The emission intensity of CASIN was found to vary with Y in a similar trend to its extent of formation. The Ca and Eu contents (expressed as molar ratios) in the synthesized products were found to increase roughly with increasing Y but were both lower than the respective Ca and Eu contents in the reactant mixtures.

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CFD validation for forces on immersed tubes in a fluidized bed

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Fluidized beds are widely used chemical processing industries and heat transfer operations for various applications. These beds are loaded with large no of tube bundles in a thermal power plant to have large surface area of heat transfer. The steam is allowed to pass though tubes placed inside and is heated by the fluidized bed material in the fluidization chamber. This work deals with estimation of the force imparted by the bed material on the tube assemblies by computational fluid dynamics (CFD) technique. The gas-solid flow has been simulated by means of a multi-fluid Eulerian model incorporating the kinetic theory for solid particles. The pulsating forces were compared to experimental data performed by Kennedy et. al. A good approximation was observed in force prediction of different tubes. However a minor difference was observed in interval duration of the peak forces. These force patterns observed will help structural designers to design tubes and joints for fluctuating forces inside the bed.

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