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Protocol for Dy3+ modified NaCaVO4 Nanophosphors in Solid-State Lighting Applications: Structural and Luminescence Investigations

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The combustion process was used to synthesize the dysprosium (Dy3+) doped Sodium Calcium Vanadate (NaCaVO4) phosphor. The structural, optical and morphological investigations were carried out with the dopant concentrations ranging from x = 0 to 3 mol% for which X-Ray diffraction, photoluminescence spectroscopy, SEM and UV-Vis spectroscopy were studied. We have explored that the XRD results indicate vibrant, clear, and well-defined peaks that are matched to the NaCaVO4 standard card confirming that the phosphor powder crystallized in orthorhombic phase with space group Cmcm. From the FESEM pictures, the particles had an agglomerated morphology with irregular shapes and sizes in the nm range. The PL properties of undoped and Dy3+ doped NaCaVO4 were investigated using a 310nm excitation source to determine the suitability for use in displays. The emission spectrum exhibited two sharp peaks at (450-500) nm and (550-600) nm and a weak peak at (650-700) nm which is assigned to Dy3+ emission transitions of 4F9/2 ⟶6H15/2 (blue), 4F9/2⟶6H13/2(yellow) and 4F9/2⟶6H11/2 (red). Doping of NaCaVO4 with Dy3+ for x = 0.25 to 3 mol% concentrations resulted in the band gap modifications in the range of 3.341 to 3.866 eV. The material that we have taken up might be investigated as a new phosphor that could be activated by UV light emitting diode (LED) light for solid state lighting and display applications.

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