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(54) Title: DOPED AMORPHOUS AND CRYSTALLINE GALLIUM OXIDES, ALKALINE EARTH GALLATES AND DOPED ZINC GERMANATE PHOSPHORS AS ELECTROLUMINESCENT MATERIALS

(57) Abstract

New oxide phosphors based on doped gallium oxides, alkaline earth gallates and germanates for electroluminescent display materials. Bright orange red electroluminescence has been obtained in amorphous and crystalline oxides $Ga_2O_3:Eu$ for the first time. $SrGa_2O_4$ and $SrGa_4O_9$ doped with 1-8 mole % of Eu and Tb, $CaGa_2O_4$, $Ca_3Ga_2O_6$ and $CaGa_4O_7$ doped with 1-4 mole % of Eu, Tb, Pr and Dy, $BaGa_2O_4$ doped with 1-2 mole % of Eu and Tb, have been prepared using RF magnetron sputtering onto ceramic dielectric substrates and annealed at 600 °C - 950 °C in air or Ar for 1-2 hours. Bright electroluminescent (EL) emission was obtained with wavelengths covering the visible spectrum from 400 to 700 nm, and infrared emission above 700 nm with spectral peaks characteristic of rare earth transitions. The films of $CaGa_2O_4$ with 1 mole % Eu achieved 22 fL (75 cd/m²) at 60 Hz and had a maximum efficiency of 0.2 lm/w for red emission. An amorphous thin film of $Ca_3Ga_2O_6$ with 2 mole % Eu achieved 34 fL in red EL at 60 Hz when annealed at 600 °C. $SrGa_2O_4$ with 1 mole % Eu and 4 mole % Tb yielded "white" phosphor having red, green and blue emission (13 fL at 60 Hz), and $SrGa_2O_4$ with 8 mole % Tb resulted in a blue and green phosphor measuring 30 fL at 60 Hz. $Zn_2Si_0.5Ge_0.5O_4$ containing Mn was sputtered using magnetron RF sputtering onto ceramic dielectric substrates and annealed at 700 °C for 1 hour in air or argon. Bright green (540 nm) emission was obtained in electroluminescence: 110 fL (377 cd/m²) at 60 Hz with a maximum efficiency of 0.9 l/w. Moderately bright red emission (640 nm) was also obtained.

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