Ln^{3+}:$KLu(WO_4)_2$/$KLu(WO_4)_2$ epitaxial layers: Crystal growth and physical characterisation

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Abstract

Different technological applications can be satisfied with Ln^{3+}:$KLu(WO_4)_2$/$KLu(WO_4)_2$ epitaxial layers, as thin disk laser and waveguiding devices.

Liquid Phase Epitaxy method(LPE) was used successfully to grow doped Ln^{3+}:$KLu(WO_4)_2$ (Ln= Tm or Yb) epitaxial layers on monoclinic $KLu(WO_4)_2$ (KLuW) substrates. Single doped macrodefect-free crystalline epitaxial layers, within 5 to 50 atom % substitution of Yb or, 5 to 10 atom % substitution of Tm were obtained by LPE using $K_2W_2O_7$ as solvent. The thickness of these thin layers can be controlled by adjusting supersaturation and time of growth during the growth process, obtaining thicknesses ranging from 5 to 150 μm. The key factors for producing optically functional epitaxial layers and their physical characterisations were studied.

KLuW crystal, used as host and passive optically substrate, was growth by Top Seeded Solution Growth Slow Cooling method (TSSG-SC) and its structural and physical characterisation were performed. Its thermal characterisation, such as linear thermal expansion, thermal conductivity and thermo-optic coefficients; and optical characterisation, such as optical tensor, and refractive index dispersion were carried out.

The structural lattice mismatches were calculated, using the unit cell parameters refined by X-ray powder diffraction, to select the optimum crystalline face to grow the epitaxial film. This was also checked experimentally, and the different growth rate for the crystalline faces were studied.