LASER EMISSIONS FROM SOLID-STATE DYE-DOPED POLYMERS

LIM CHIE HAW

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ABSTRAK

18.8 μm masing-masing. Bagi filem-filem PVA dop-C460 yang berketebalan substrak yang berlainan, kecepatan laser optima yang sebanyak 18.67% telah dicapai dari substrak kaca yang berketebalan 3 mm. Peranan substrak kaca ketika pengujian filem PVA dop-pewarna telah dikenalpastikan sebagai pemandu-gelombang berbilang yang mengizinkan foton-foton kembali ke filem untuk penyumbangan kepada proses stimulasi.
ABSTRACT

Laser emissions were obtained from dye-doped polymers, namely, C460/PMMA, R6G(ClO₄)/PMMA, C460/PVA and R6G(ClO₄)/PVA, under the excitation from a Transversely Excited (TE) nitrogen laser. C460/PMMA and R6G(ClO₄)/PMMA slabs were fabricated by using a low-pressure-compression molding method; whereas C460/PVA and R6G(ClO₄)/PVA films were fabricated in the form of thin films by using the dip-coat method. Laser efficiencies of 8.7% and 3% were achieved from the optimum dye concentrations of R6G(ClO₄)/PMMA (1 × 10⁻³ M) and C460/PMMA (2.25 × 10⁻² M) respectively. For dye-doped PVA thin films, the laser efficiencies of 8.27% and 6.3% were obtained from the optimum dye concentrations of C460/PVA (8 × 10⁻³ M) and R6G(ClO₄)/PVA (2.5 × 10⁻³ M) respectively. R6G(ClO₄) showed better compatibility than C460 when doped into PMMA. However, C460 showed better compatibility when doped into PVA. The refractive indices of these dye-doped polymer films were measured and used to estimate the thickness of the thin films. Investigations were carried out on the laser performance of C460-doped PVA films with varying film thickness, the presence of aluminium coating on glass substrate, and different glass substrate thickness. Maximum laser efficiency of 17% had been achieved at film thickness of about 30 μm. For aluminium-coated glass substrate, the laser output depended on whether the aluminium layer was in between the dye-doped PVA film and the substrate, or the substrate was in between the dye-doped PVA film and the aluminium layer. High efficiencies were obtained only from the latter case where laser efficiencies of 10.91%, 11.95% and 13.36% were obtained for film thicknesses of 11.5 μm, 14.9 μm and 18.8 μm respectively. For dye-doped PVA films on different glass substrate thickness, the optimum laser efficiency of 18.67% was achieved with glass substrate thickness of 3 mm. The role played by the
glass substrate during the excitation of dye-doped PVA film has been shown as that of a multiple waveguide which allows the photons to return to the film and contribute to the stimulated emission process.
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