ABSTRACT

A hot-press moulding method was used for the fabrication of R640 (ClO_4)- and R6G (ClO_4)-impregnated poly(methylmethacrylate) (PMMA) dye lasers. The dyes were incorporated into the PMMA matrix by dissolving both the dye and PMMA in an organic solvent; evaporation of the solvent in a 175°C vacuum oven furnished a spongy material, which was then moulded into solid-state dye lasers of approximately 8% efficiency. R6G (ClO_4)-doped PMMA slabs suffered only a <10% drop in efficiency after having been operated for 850 pulses at 0.3 Hz. Moulding the preform at <1 mbar eliminated the formation of air bubbles in the slabs, and annealing the slabs minimised light scattering caused by the presence of adventitious solvent trapped in the matrix. The thermal stability of the dyes and the operational lifetime of the dye lasers depended on the nature of the solvent system that was used in the preparation of the preform. This study documents the first example of the use a hot-press moulding procedure for solid-state dye lasers that completely eliminates the radical-initiated decomposition of dyes, a problem associated with conventional fabrication methods in which the monomers are polymerised in the presence of the dyes.