

Rare-earth-ion-doped double-tungstate waveguides

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It has been recognized that the monoclinic double tungstates $KY(WO_4)_2$, $KGd(WO_4)_2$, and $KLu(WO_4)_2$ possess a high potential as rare-earth-ion-doped solid-state laser materials, partly due to the high absorption and emission cross-sections of rare-earth ions when doped into these materials. Besides, their high refractive indices make these materials potentially suitable for applications which require optical gain and high power in integrated optics, with rather high integration density. This paper reviews the recent advances and presents our work at the Ecole Polytechnique Fédérale de Lausanne, Max-Born-Institute in Berlin, and University of Twente in Enschede towards the demonstration of $KY(WO_4)_2$ waveguide lasers and their integration on a chip. Thin layers of rare-earth-ion-doped $KY(WO_4)_2$ were grown on undoped substrates by liquid phase epitaxy. Optical waveguiding with propagation losses of 0.1-0.2 dB/cm was achieved. Recently, we have demonstrated $KY(WO_4)_2:Yb^{3+}$ and $KY(WO_4)_2:Tm^{3+}$ planar waveguide lasers at 1 μm and 2 μm , respectively. With the former, we have achieved 290 mW of output power and >80% slope efficiency. Channel waveguides have been prepared by reactive ion etching, light ion implantation, or femtosecond laser writing. Optical investigations of these channel waveguides are under way.