Double Tungstate Lasers: From Bulk Toward On-Chip Integrated Waveguide Devices

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***Abstract*—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 indexes make these materials potentially suitable for applications that require optical gain and high power in integrated optics, with rather high integration density. We review the recent advances in the field of bulk lasers in these materials and present our work toward the demonstration of waveguide lasers and their integration with other optical structures on a chip.**

***Index Terms*—CW lasers, dielectric materials, dielectric waveguides, epitaxial layers, integrated optics, ion implantation, optical waveguides, optical planar waveguides, optical strip waveguides, pulsed lasers, rare earth compounds, solid lasers, thulium compounds, tungsten compounds, ytterbium compounds.**

ness, and stimulated Raman scattering (SRS)-active vibration modes] can be found in [5] and [6]. Many laser relevant properties like refractive index, optical transparency, and thermal conductivity are very similar for the three undoped monoclinic double tungstates [5], [6]. They exhibit one of the largest absorption and emission cross sections and broader linewidths when doped with rare-earth ions, which may be partly due to the high refractive indexes and partly due to the strong anisotropy [7], [8]. Another important advantage of the rare-earth-ion-doped monoclinic potassium double tungstates is the relatively large ion separation allowing highest doping levels with minimum quenching effects.

In this paper, we review the recent advances in the field of Yb and Tm bulk lasers based on monoclinic double tungstates KYW, KGdW, and KLuW, and present our work toward the