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2 MICRON LASER MATERIALS FOR REMOTE ATMOSPHERIC SENSORS

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At the present time there is a great interest in developing a laser operating in the mid IR, eyesafe region ($\sim 2 \mu\text{m}$) for remote sensing measurements of wind shear from aircraft and global winds from space using doppler LIDAR. Another application is the measurement of trace gases in the atmosphere using differential absorption lidar (DIAL); shifting the wavelength of a $2 \mu\text{m}$ source will extend the number of trace gases accessible in DIAL measurements.

Increasing availability of high power diode lasers for pump sources offers considerable promise for these applications. A diode-laser-pumped solid-state-laser is a good candidate for space applications because it can be compact, efficient and reliable.

In searching for new $2 \mu\text{m}$ laser materials for these lasers, we have made comprehensive spectroscopic analysis of YAG and YLF crystals doped with various concentrations of Tm and Ho. We compared the energy transfer rates and loss mechanisms, under the excitation of pulsed dye and cw diode lasers, that would directly effect the efficiency of the laser emission in the $2 \mu\text{m}$ region from Ho. We have found significant differences in the behavior of Tm and Ho ions in YAG and YLF. The cross relaxation rates in Tm and the energy transfer rate from Tm to Ho are approximately twice as fast and losses in $2.1 \mu\text{m}$ emission are 30 % less in YLF than in YAG. These results indicate that if the concentrations of Tm and Ho ions are optimized for these materials, the YLF laser can operate more efficiently than the YAG laser under diode laser pumping.