

(Cr⁴⁺:BeAl₂O₄) crystal produced sub-100 fsec pulses when pumped at 1.06 μm.¹¹ Thus, chromium-doped solid state laser sources offer the next generation of compact, tunable, ultrashort pulse laser sources.

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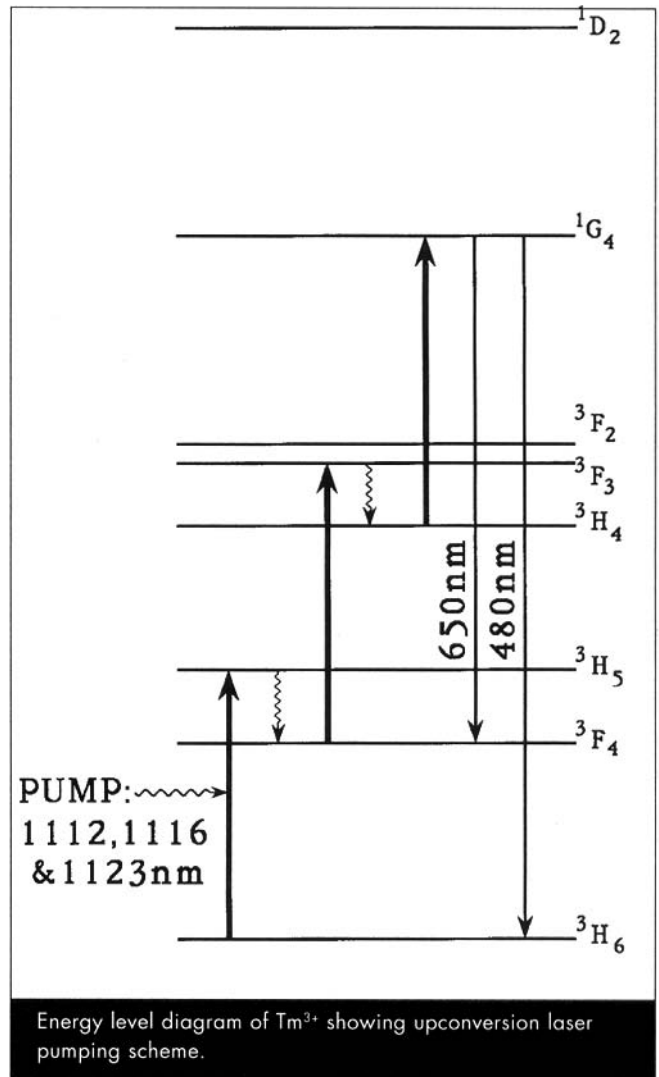
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CW Room-Temperature Blue Upconversion Laser

S.G. Grubb, K.W. Bennett, R.S. Cannon, and W.F. Humer, Amoco Technology Co., Naperville, Ill.

There has recently been tremendous interest in the development of efficient, compact, long-lived, solid state blue laser sources. Whereas most diode-based blue sources use frequency doubling or mixing techniques, the process of upconversion has attracted a great deal of interest due to the simplicity of this approach used to convert infrared laser diodes to visible light. Recently, the advantages of the fiber laser geometry for upconversion lasers have become apparent and have led to the demonstration of 11 different cw, room temperature visible upconversion laser/pumping combinations. Blue upconversion fiber lasers have been demonstrated in both Tm³⁺ and Pr³⁺-doped ZBLAN fibers, but the Tm³⁺ version required pumping with two different red wavelengths and operation at 77 K,¹ while the Pr³⁺ fiber laser required the use of two widely spaced infrared wavelengths.²

We report what we believe is the first single-wavelength pumped, cw, room temperature, blue upconversion laser. This 480 nm laser uses Tm³⁺ as the active ion in a fluorozirconate glass fiber. The pump source is a Nd³⁺ laser made to operate in the 1120 nm spectral region by the suppression of the dominant 1064 nm lasing line. The population of the lasing level requires the sequential absorption of three photons, as shown in the figure. A lasing threshold of 25 mW of absorbed pump and a slope efficiency of 32%



versus absorbed pump power has been observed. A maximum output power of 57 mW was measured at 480 nm and recent results with fiber lasers suggests that the output power should be scalable to very high cw output powers. A diode-pumped Nd³⁺ laser was built at 1123 nm and up to 40 mW of blue has been observed from the Tm³⁺ fiber laser. Upconversion lasing at 650 nm was also observed from this same upper state in a Tm/Yb co-doped ZBLAN fiber.

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