TUNABLE ROOM TEMPERATURE LASER ON COLOR CENTERS IN $KMgF_3$

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Tunable room temperature laser operation of color centers in a $KMgF_3$ crystal has been obtained for the first time. The 15% efficiency and 710–840 nm tuning range has been achieved by the frequency doubled output of a Q-switched YAG laser. Color centers photobleaching under pump laser radiation was investigated.

1. Introduction

Color centers in a nominally pure $KMgF_3$ crystal with uncontrolled impurity concentration of less than 10^{-3} mole % have been investigated recently [1–5]. Hall [1] identified the color center with absorption band at 340 nm as due to V_k centers. Crystals irradiated at room temperature have shown six absorption bands [2]: A(280 nm), B(440 nm), B′(402 nm), C(565 nm), C′(500 nm) and D(375 nm). Excitation of the B, B′ and D-bands resulted in luminescence with λ_{max} 566, 490, 416 nm, respectively. Excitation in the A, C and C′-bands produced no luminescence. The A-band was identified with F-centers and the B-band was related to F_2 color centers.

The absorption band at λ_{max} = 395 nm (λ_{max}^{lum} = 465 nm in 3, 4) was associated with F_3 centers. In crystals irradiated at low temperature and annealed to room temperature 750 nm luminescence was observed under 577 nm excitation at 77 K [4].

It is for the first time we report on the tunable room temperature laser action of a color center (C band) by the double frequency pump of a Q-switched YAG laser.

The photostability of these color centers under the influence of intense pumping irradiation is also discussed.

2. Experimental details

A $KMgF_3$ crystal grown by the Stockbarger method in an argon atmosphere has been used in the experiment. The impurity content was measured by spectral and activation methods and did not exceed 10^{-3} mole %. Irradiations were performed with ^{60}Co γ-rays. The absorption spectra were measured on a Beckman spectrophotometer (Model UV5270). Luminescence kinetics were investigated with a PRA-nanosecond fluorimeter. Laser elements dimensions were ϕ 4–5–20–50 mm^3. Rods were inserted in a spherical resonator formed by the wideband mirror (R = 99.8% within 600–900 nm) and the coupling mirror (R = 50–90). The spherical lens (f = 250 mm) focused double-frequency radiation of the Q-switched YAG laser (Quantel, Model 480C, $E_{0.53}$ = 50 mJ, t_p = 12 ns) into the active element. A three-prism selector has been used as a tuning element. Dye laser irradiation (λ = 600 nm, R6G in PMMA) was also used for pumping Longitudinal excitation was employed. There was no matching between the caustics of resonator and focused radiation. Generation energy was measured with laser photometer R_j-7200 with pyroelectric sensors (Laser Precision Corporation) providing measurement of the energy value within 10^{-7} – 1 J. The generation spectrum was recorded on an OMA system including polychromator, vidicon with silicon target and MFR-102 microcomputer (Compdata Company).

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