The measurement results agree with those of [7], in which it is reported that Al_{27}^{+11} ions with 15 keV energy were obtained, and that their number was smaller by two orders of magnitude than the number of singly-charged ions at an approximate laser radiation flux density 2×10^{12} W/cm^2.

Assuming that the ions with z = 1 are emitted mainly isotropically [8], we find that $\sim 10^{14}$ ions are emitted by the plasma. At the same time, the number of atoms ejected from the target is 10^{18} (estimated from the volume of the produced crater). The relative yield of the ion emission is thus $\sim 10^{-4}$. This is in satisfactory agreement with the ion emission estimated in [9]. Recalculation in terms of the total emission angle shows that the lower limit of the number of Al_{27}^{+13} ions is $10^9 - 10^{10}$ per laser pulse. This number of bare Al_{27}^{+13} nuclei can be greatly increased by using more powerful lasers [10].

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NEW CW CRYSTAL LASERS

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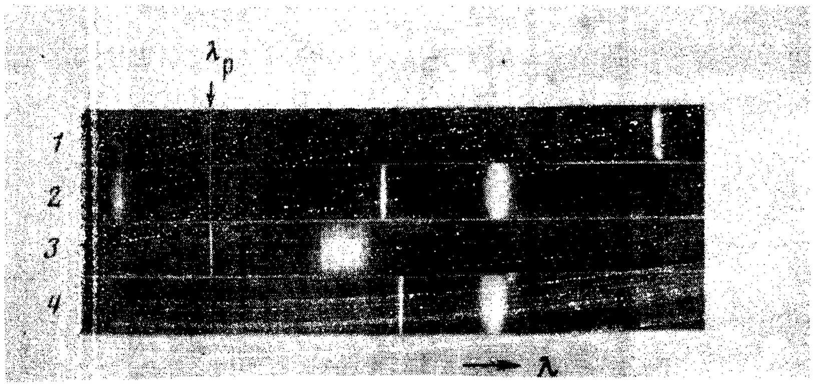
Searches for new active crystalline media for high-power cw lasers have recently acquired a particular importance. This is fully evidenced by the

1)This work was performed in collaboration with members of the Crystallography Institute of the USSR Academy of Sciences, the Institute of General and Inorganic Chemistry of the Siberian Division of the USSR Academy of Sciences, the Physics Research Institute of the Armenian Academy of Sciences, and the M.D. Mendeleev Moscow Chemical Technology Institute.

	$KY(WO_4)_2$	$Lu_3Al_5O_{12}$	$LiGd(MoO_4)_2$	$Y_3Al_5O_{12}$
Space group	$C^6_{2h} - C2/c$	$O_h^{(10)} - Ia3d$	$C^6_{4h} - I4_1/a$	$O_h^{(10)} - Ia3d$
Cation point symmetry[1]	$C_2(Y^{3+})$	$D_2(Lu^{3+})$	$S_4(Gd^{3+})$	$D_2(Y^{3+})$
Refractive index[2]	~1.9	~1.8	~1.95	1.823
$C^{opt}_{Nd^{3+}}$[3], at.%	2,5 – 3,0	1,2 – 1,3	2,5 – 3,3	1,2 – 1,3
τ_{lum}[4], μsec	110 ± 10	250 ± 10	140 ± 10	250 ± 10
Lasing wave length, Å	10688 ±0,3	10642,5 ±0,2	10599 ±1	10641,5 ±0,2
σ_e, 10^{-19} cm^2	4,1[5]	5 – 9	0,9 – 1,5	~7,5
$\Delta\nu_{lum}$[6], cm^{-1}	20,6	~5,3[10]	~80	~5[10]
Luminescence line broadening	homog.	homog.	inhom.	homog.
Splitting of state $^4F_{3/2}$ cm^{-1}	112	67	~77	84
Final level[7], cm^{-1}	1944	2099	~1965	2110
E_{thr}[8], J	~0,3	1,1	1,3	0,5
P_{thr}[9], W	~400	950	1150	~400
Radiation polarization	pol.	none	weak pol.	none
$\delta\lambda_r/\delta T$, 10^{-2} Å/deg	0,85	~4,3	–	4,85

Notes: [1]Cation replaced by Nd^{3+} ion; [2](λ = 1.06 μ), averaged refractive indices are given for the anisotropic crystals; [3]the optimal activator concentration was determined from luminescence line intensity in the $^4F_{3/2} \rightarrow {}^4I_{11/2}$ transition; [4]the luminescence lifetime of the metastable state $^4F_{3/2}$ is given for $C > 0.3$ at.%, at which there is practically no concentration quenching; [5]the listed cross section corresponds to luminescence in a direction parallel to the crystallographic b axis, and $\sigma_e = 1.8 \times 10^{-19}$ cm^2 for the perpendicular direction; [6]line width of luminescence causing the given induced transitions; [7]four-level laser operation; [8]the generation threshold was measured in an elliptical illuminator with an Xe lamp type IFP-400, surrounded by a ZhS-17 glass filter; [9]in an elliptical illuminator with a continuously-operating DKsTV-3000 Xe lamp; [10]the values of $\Delta\nu_{lum}$ were obtained after resolving the contour of two superimposed luminescence lines.



Stimulated-emission lasers with spectra of Nd^{3+}-doped crystals: 1) $KY(WO_4)_2$, 2) $Lu_3Al_5O_{12}$, 3) $LiGe(MoO_4)_2$, 4) $Y_3Al_5O_{12}$. The arrow indicates a reference line with λ_p = 10 561.5 Å

progress attained in the development of effective parametric generators and harmonic generators with almost 100% conversion of IR into visible light, and their use in such basic physical research as laser photochemistry, molecular spectroscopy, or Raman spectroscopy. Of course, the high-power laser applications still remain a timely topic.

We report here three new cw lasers based on the crystals $KY(WO_4)_2$, $Lu_3Al_5O_{12}$, and $LiGd(MoO_4)_2$, activated with Nd^{3+} ions. Their main spectroscopic and lasing characteristics are gathered in the table. For comparison, the table lists also the parameters of the widely used crystal $Y_3Al_2O_{12}:Nd^{3+}$, which is now widely used in quantum electronics. All the data are given for room temperature.

The crystals used in the lasing experiments were polished rods 25 mm long and of ~5 mm diameter. The end faces were plane-parallel within about 10". The optical resonator was made up of confocally-mounted external multilayer dielectric mirrors (τ_{mir} > 1% at 1.06 μ wavelength). In the cw regime, the crystals and the lamp were cooled with running water. At an excitation power 2000 W and at τ_{mir} = 3%, using the crystals $KY(WO_4)_2$ and $Y_3Al_5O_{12}$ with near-optimal activator contents and $Lu_3Al_5O_{12}$ with ~0.6 at.%Nd^{3+}, we registered output powers 550, 600, and 350 mW, respectively. The figure shows the generation spectra of the investigated lasers, obtained at 300°K and with an exciting energy three times threshold.

Since the wavelengths of ordinary lasers with $Y_3Al_5O_{12}:Nd^{3+}$ and $Lu_3Al_5O_{12}:Nd^{3+}$ are close to each other at 300°K, the spectra are shown for the case of lasers with a combined active medium. The spectrum of the $Lu_3Al_5O_{12}:Nd^{3+}$ crystal contains in addition to the 10 642.5 Å line also two lines with wavelengths ~10 535 and ~10 610 Å.

In conclusion, we add that we have also discovered pulsed stimulated emission of a number of other TR^{3+} ions in these crystals. Their properties will be reported in separate articles.

TRANSFER OF VIBRATIONAL ENERGY FROM OD TO CO_2

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We report here for the first time observation of effective energy transfer from the radical OD to CO_2 molecules. This transfer leads to a laser effect in a mixture of O_3, D_2, and CO_2 at a wavelength 10.6 μ. Using a simple analytic model of the reaction and the measured temporal characteristics of the