Formation and control of emission of a solid-state laser

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## ABSTRACT

In this work an intracavity adaptive system for controlling the radiation of a CW YAG:$Nd^{3+}$ laser is proposed. Two types of correctors were worked out: a tilt corrector and a bimorph flexible mirror (BFM).The system permits to reduce by three times laser beam divergence, to decrease by ten times the power instability and to form various output intensity distributions.

Parameters of a laser beam depend on different intracavity distortions. In the majority of cases these distortions act as pure phase ones: fluctuations of refractive index of active medium, thermal mirror deformations etc. This distorts the spatial distribution of the radiation intensity and increase the beam divergence. Placing an electronically controlled mirror into cavity one can reduce such undesirebale effects, influence the geometry of the generated modes and suppress the output power fluctuations.

In this work we used two types of adaptive mirrors: a tilt corrector and a BFM. Our first task was to stabilize output power of the CW YAG:$Nd^{3+}$ laser both 1,064$\mu$ and second harmonic (0,53$\mu$) radiation. For this purpose COAT feedback with simple tilt corrector was used. The main results were - 10 times reduction instability of 1,064$\mu$ radiation and 15 times - 0,53$\mu$ radiation. The YAG:$Nd^{3+}$ laser was employed as an example to show the possible correction of the lower aberrations of a thermal lens by the 17 electrode BFM[1]. Under the laser pump current variation from 10 to 34 A the fivefold compensation for the thermal lens astigmatism and other aberrations was obtained. For enlarging the laser beam on BFM we proposed a resonator shown on Fig. 1. As expanding lens we used the end of the active

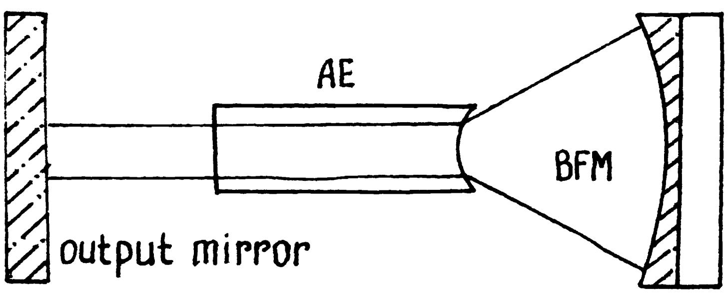


Fig. 1.

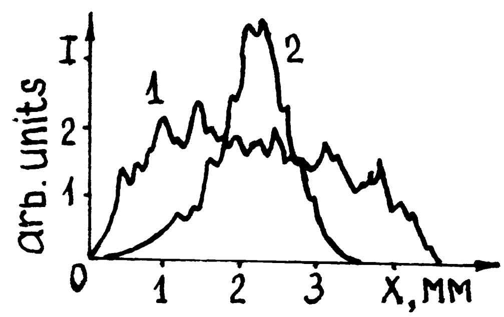


Fig. 2.

element (AE) with meniscus. Our BFM differed from the one used in Ref. 1 because it had the form of a concave mirror even without any applied voltage to the electrodes. On the Fig. 2 we show the possibility to reduce the laser beam divergence choosing the voltage on BFM electrodes. Output laser beam profile in the multymode regime of generation is shown by curve 1. Curve 2 on Fig. 2 demonstrates the possibility of threefold reduction of laser beam divergence by the intracavity BFM. Also the experimental results of intracavity formation of radiation spatial structure were obtained. Intracavity phase correction made it possible to influence the output near-field and far-field radiation intensity distribution.

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