SELF-ADAPTIVE LASER RESONATORS USING DEGENERATE FOUR-WAVE MIXING IN A PROXIMITY-COUPLED SIDE-PUMPED Nd:YVO_4 AMPLIFIER

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Abstract

Degenerate four-wave mixing (FWM) techniques used to produce self-adaptive laser resonators based on diffraction from a gain grating have shown considerable promise for correction of distortion in high-power solid-state laser systems. In these systems, the gain grating is formed by spatial hole burning caused by interference of coherent beams in the laser amplifier and modulation of the population inversion. The gain grating formation can be used for phase conjugation by using the amplifier in a four-wave mixing geometry, for self-pumped phase conjugation by using an input beam in a self-intersecting loop geometry and for formation of a self-starting adaptive oscillator by providing additional feedback from an output coupler and requiring no external optical input.

Successful demonstrations of such a self-adaptive resonator have been performed recently in diode side-pumped Nd:YVO_4 [1] whose operation is based on the very high reflectivities (>800%) [2] and more recently (>10,000%) of a gain grating formed in a diode-bar side-pumped Nd:YVO_4 amplifier. This resonator has been shown to correct for severe distortions introduced inside the loop with a maximum output of ~7.2 W so far achieved.

We will present results of increased resonator outputs by proximity-coupling of the pump diode straight to the FWM amplifier region resulting in higher gains, whereby the diode emitting facet is placed around 50 microns from the pump face of the amplifying crystal Output powers of the order ~10 W should be achievable, and we will present modelling data for such proximity-coupled geometries

[1] M.Trew, G. J. Crofts, M. J. Damzen, . Hendricks, S. Mailis, D. P. Shepherd, A. C. Tropper, R. W. Eason, 'Multiwatt continuous-wave adaptive laser resonator', Opt. Lett., 25, 18 (2000)

[2] S. Mailis, J. Hendricks, D. P. Shepherd, A. C. Tropper, N. Moore, R. W. Eason, G. J. Crofts, M. Trew, M. J. Damzen, 'High-phase-conjugate reflectivity (>800%) obtained by degenerate four-wave mixing in a continuous-wave diode-side-pumped Nd:YVO_4 amplifier', Opt. Lett., 24, 14 (1999)