Yb:S-FAP Multipass Side-Pumped Amplifier

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Abstract

We report a diode side-pumped, single-stage, multi-pass Yb:S-FAP amplifier designed to achieve high pump brightness, uniform absorption, and high amplification. We demonstrate highly efficient operation of the amplifier with an input signal from a Nd:YLF oscillator.
Schematic of the amplifier set up
Single-pass Gain

![Graph showing the relationship between total pump peak power (W) and actual gain. Theoretical and experimental data points are depicted.](image-url)
Calculated pump intensity and gain across the width of the slab

![Graph showing calculated pump intensity and gain across the width of the slab. The graph includes a line graph with markers indicating gain and intensity levels. The x-axis represents the position along the width of the slab in cm, ranging from 0 to 0.9. The y-axis represents the intensity and gain values, ranging from 1.35 to 1.4 for gain and from 2 to 3 for intensity. The data points indicate a consistent trend with minor variations.]
Experimental layout

Cylindrical lens

Yb:S-FAP five-pass amplifier

Nd:YLF Oscillator

Isolator

Nd:YLF pre-amplifier

Cylindrical lens

Isolator

Cylindrical lens
Output energy vs pump power at different input pulse energies for five-pass amplification
Five-pass amplification for different input pulse energies at total pump power of 160 W.
Conclusions

- We have demonstrated the first, to our knowledge, diode side-pumped, multi-pass Yb:S-FAP amplifier.

- Using quasi-CW diode lasers with peak powers of 80 W and pulse widths of 1.2 ms, we obtained a maximum slope efficiency of 14% with 16 mJ of energy per output pulse.