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5 Watt Zinc Germanium Phosphide Optical Parametric Oscillator

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Abstract content
 (Max 300 words)

Lasers operating in the mid-infrared region from 3 – 8 μm find use in industrial, medical, military and scientific applications. Spectral fingerprints of molecular gasses in this region allow trace gas and chemical agent detection. High atmospheric transmission in this region also facilitates free-space communications, active imaging and other remote sensing or long distance applications.

Laser sources emitting in the mid-infrared include quantum cascade lasers, optically-pump semiconductor lasers and parametric sources (converting from 1 or 2 μm Q-switch solid-state lasers). Quantum cascade lasers with high wall-plug efficiencies, compact size and continuous wave output below 5 W suit the criteria for a number of applications. However when high power or pulsed operation is required, an optical parametric oscillator (OPO) remain the source of choice.

Traditional mid-infrared OPO's utilise periodically-poled lithium niobate (PPLN) or potassium titanyl phosphate (PPKTP) pumped with readily available 1 μm laser sources. A more efficient route for parametric conversion is to pump a zinc germanium diphosphide (ZGP or ZnGeP_2) non-linear crystal with a 2 μm laser source, such as a Q-switched Holmium solid-state laser.

We previously reported on a 1 W, 5 kHz ZGP OPO at SAIP 2012. In this paper we present the recent results of a redesigned high power high repetition rate doubly-resonant ZGP OPO, single-pass pumped with a new 45 W Ho:YLF 2 μm pump laser (pump laser to be discussed by W. Koen in a separate SAIP 2013 paper). The OPO and pump telescope was redesigned for a smaller mode-size and improved mode-matching. Output powers were scaled to 4.2 W at 25 kHz and 5.2 W at 20 kHz.

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Primary author: Mr JACOBS, Cobus (CSIR National Laser Centre)

Co-author: Mr KOEN, Wayne (CSIR National Laser Centre)

Presenter: Mr JACOBS, Cobus (CSIR National Laser Centre)

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