Chromacity™

Nonlinear Mid-Infrared Generation

using the Chromacity 1040

The high average power and high peak power of the Chromacity 1040 can be used to generate mid-infrared light from 1.4 – 4 µm by pumping optical parametric oscillators. These OPOs can be used as a source for broadband infrared spectroscopy, Fourier-transform spectroscopy and stand-off detection.

Optical Parametric Oscillators

The nonlinear response of certain crystals, such as lithium niobate, allows the generation of shorter wavelengths via second-harmonic generation and sum-frequency mixing, or longer wavelengths by parametric down-conversion. OPOs make parametric down-conversion highly efficient by placing the nonlinear crystal inside a high-reflectivity cavity.

Converting a regular sequence of femtosecond pulses using an OPO requires the use of a cavity which is exactly length matched ("synchronous pumping") to that of the Chromacity 1040 laser, for example a simple 4-mirror design (Fig. 2). Tuning in a synchronously pumped OPO is available by either changing the crystal angle / grating period or adjusting the cavity length.

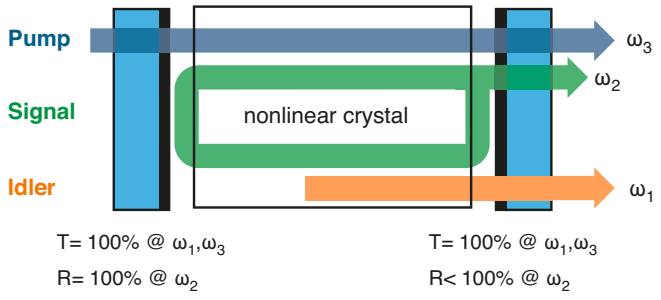

FIGURE 1. Schematic representation of an optical parametric oscillator

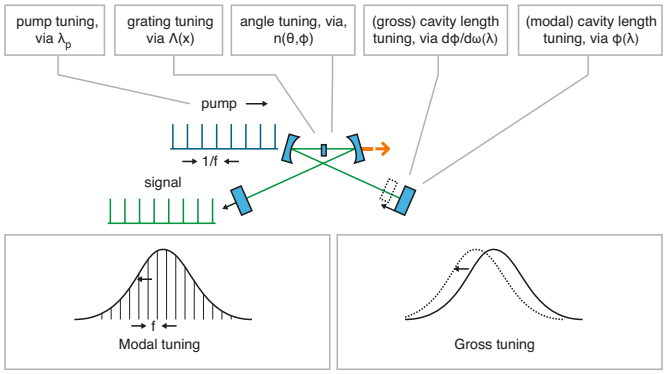

FIGURE 2. Layout and tuning implementation in a synchronously pumped optical parametric oscillator

FIGURE 3.
The Chromacity 1040

Optical parametric oscillators can be used as a source for broadband infrared spectroscopy, fourier-transform spectroscopy and stand-off detection.

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Optical parametric oscillator pumping using the Chromacity 1040

The Chromacity 1040 can easily generate a broad range of wavelengths using a commercial off-the-shelf MgO:PPLN crystal[1]. Fig 4. shows spectra of the mid-infrared idler and near-infrared signal that is typically generated. Tunability throughout the 1.4-2.0 µm and 2.1-4.2 µm regions is obtainable using a suitable MgO:PPLN crystal and mirror set. Powers of around 10 mW in the idler and 50 mW in the signal are available with picosecond pulsed output, higher powers are provided in a quasi-CW regime.

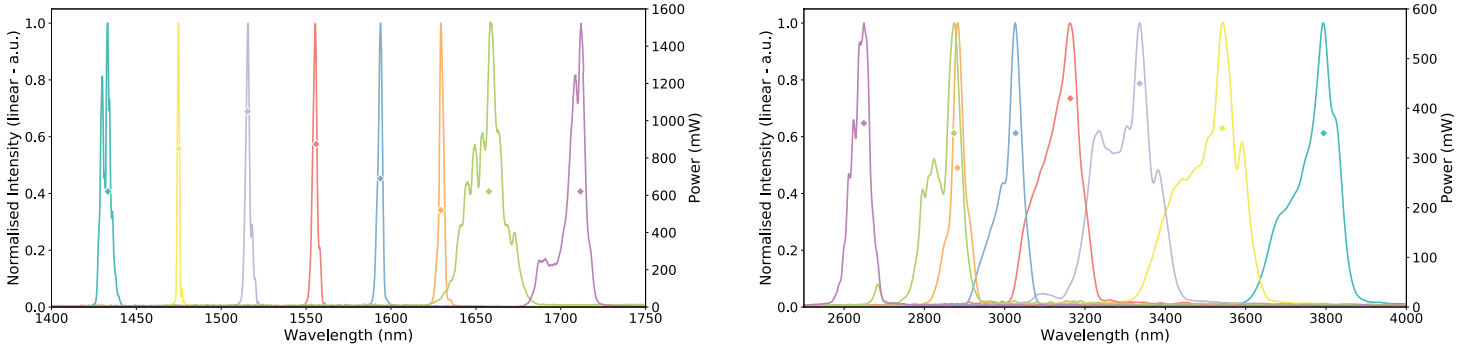

FIGURE 4. Signal (left) and Idler (right) spectra obtained from the Chromacity OPO pumped by the Chromacity 1040

Summary

Using optical parametric oscillation, output from the Chromacity 1040 can be converted into the near and mid-infrared spectral region. Its excellent stability allows synchronously-pumped OPOs to operate with high stability across a wide wavelength range.

We offer tunable optical parametric oscillators that cover both near and mid-IR. Our OPOs are optically pumped by the Chromacity 1040, which is fully integrated into the optical head to maximise stability and reduce the overall footprint.

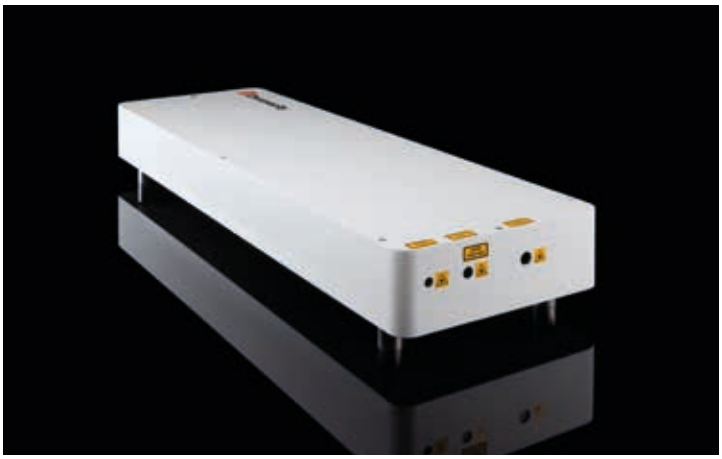

Figure 5. The Chromacity OPO

References 1. MOPO1-0.5-1 crystal from Covesion (www.covesion.com)

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