Dual Comb Spectroscopy Based on Ultrafast Polycrystalline Cr:ZnS Lasers

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Mode-locked polycrystalline Cr:ZnS lasers have recently emerged as a new platform for conventional Fourier transform spectroscopy (FTS) and for dual comb spectroscopy DCS in the broad spectral range spanning from the THz to the UV [1-3]. Their main feature is an inherent noise suppression that occurs via instantaneous nonlinear losses due to random quasi phase matching process in polycrystalline Cr:ZnS gain elements. As a result, high power (typically >3 W), few cycle (<24 fs) polycrystalline Cr:ZnS comb sources have ultra-low intensity and phase noise [4]. Further, the 2.4 µm central wavelength of Cr:ZnS lasers is favorable for efficient down- and up-conversion in readily available nonlinear materials.

We demonstrate that the combination of ultrafast polycrystalline Cr:ZnS lasers with the state-of-the-art servocontrol and computer systems for real-time signal processing enables spectroscopy with unprecedented performance envelope in terms of speed, bandwidth, resolution and dynamic range. That, in turn, potentially allows to use IR spectroscopy in the applications that currently belong to a realm of mass spectrometry. We plan to utilize the developed spectrometer for applications that rely on diagnostics of complex gas mixtures, *e.g.*, exhaled human breath.

References

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