BROADBAND LUMINESCENT MATERIALS IN WAVEGUIDE GEOMETRY

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In recent years, broadband fiber interferometers have become very popular as basic instruments used in optical low-coherence reflectometry for diagnostics of fiber and integrated optics devices or in optical coherence tomography (OCT) for imaging applications in the biomedical field. The longitudinal resolution of such instruments is inversely proportional to the optical bandwidth of the light source. Broadband luminescence from transition-metal-ion doped materials can significantly improve the longitudinal resolution compared to superluminescent diodes, but the low brightness of its luminescence typically leads to a low dynamic range in OCT. Femtosecond lasers based on, e.g., Ti:sapphire have, therefore, been used as large-bandwidth high-brightness light sources, and subcellular imaging has been demonstrated in this way. Since current femtosecond light sources do not necessarily meet the requirements of compactness, ease of use, and low cost, a suitable light source for OCT is still not available.

We have demonstrated the suitability of a superluminescent Ti:sapphire crystal as a light source in the wavelength region 700-1000 nm for OCT with ~2 µm axial resolution [1]. Single spatial mode, fiber coupled output powers of ~40 µW can be generated using a 5 W pump. Guiding of the fluorescence in planar-waveguide geometry can further increase the single-mode fluorescence output powers [2]. Ultimately, in a channel-waveguide geometry that we have successfully created in Ti:sapphire [3], the coupling efficiency of fluorescence emission into a single-mode fiber is expected to further increase to the mW level. The significantly improved sensitivity that will result at this fluorescence power may allow for rapid *in vivo* ultrahigh-resolution OCT with a simple broadband light source.

[1] A. Kowalevicz et al., Opt. Express **10**, 349 (2002)
[2] M. Pollnau et al., Opt. Lett. **26**, 283 (2001)
[3] A. Crunteanu et al., Appl. Phys. B, accepted