ADVANCING FEMTOSECOND STIMULATED RAMAN MICROSCOPY (FSRM)

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Key Words: Raman microscopy, stimulated Raman scattering, polymer science.

Raman microscopy exploits the molecular specificity of vibrational spectroscopy to obtain chemical maps of microscopic objects. Low Raman cross sections and concomitantly long acquisitions times hamper its application. This has triggered tremendous efforts to decrease acquisition times by non-linear Raman scattering. Coherent anti-Stokes Raman scattering (CARS) [1] and stimulated Raman scattering (SRS) [2,3] are presently employed. For either approach, there is a trade-off between spectral coverage and acquisition times (see Figure 1) [4]. Femtosecond stimulated Raman microscopy (FSRM), introduced by us in 2007 [2], allows for a large spectral coverage – a complete Raman spectrum is recorded simultaneously.

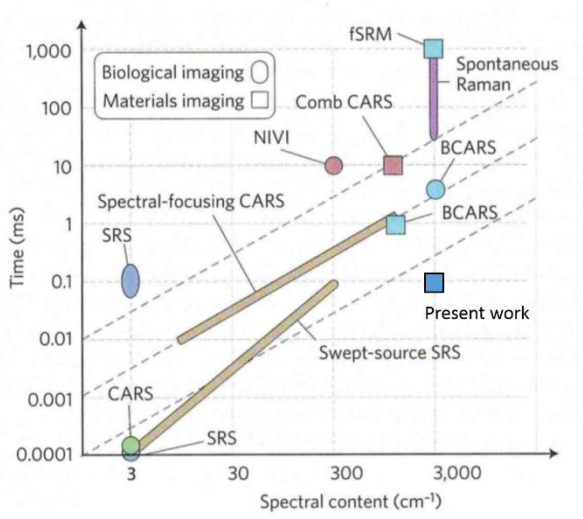

Figure 1**:** Trade off between spectral coverage (abscissa, complete coverage ~ 3000 cm^{-1}) and acquisition time per pixel (ordinate) in non-linear Raman microscopy. Ovals represents applications in bio-imaging, squares in materials imaging. Adapted from ref. [4].

In this contribution developments resulting in a reduction of acquisition times down to 0.1 ms [5] per pixel will be summarized. Potentials for further reductions as well as technical and physical limits will be discussed. Examples for the application of the instrument in polymer science will be given.

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