二重偏光ハイパースペクトル誘導ラマン顕微法

Dual-polarization Hyperspectral Stimulated Raman Scattering Microscopy

東大[1] ○寿 景文[1], 小関 泰之[1]

Univ. of Tokyo[1] ○Jingwen Shou[1], Yasuyuki Ozeki[1]

E-mail: shou_jingwen@ginjo.t.u-tokyo.ac.jp

Polarization-resolved stimulated Raman scattering spectroscopies [1] and microscopies [2] have been utilized to investigate the symmetry and orientation of molecular vibrational modes and to provide extra spectral signatures, while the polarization modulation introduced additional complexity and the successive measurement on different polarization states limits the imaging speed. Here we demonstrate dual-polarization hyperspectral stimulated Raman scattering microscopy which enables detailed imaging measurement in two orthogonal polarization states simultaneously at video-rate speed. Two polarized Raman images can be obtained within ~0.03 s, while the Raman shift is scanned in the CH stretching region in 3 s by virtue of rapid wavelength tunability of laser pulses. We observed different kinds of polymer beads and liquid, the results of which prove the ability to measure the symmetry of vibrational modes and to distinguish the overlapped peaks. Moreover, HeLa cells and live Chinese hamster ovary cells were imaged to prove the applicability to biological samples and show additional spectral signatures in perpendicular spectra. This novel method endows fast yet detailed imaging analysis of biomolecules in live specimens to research on drug delivery, electric stimulation, metabolic engineering etc.

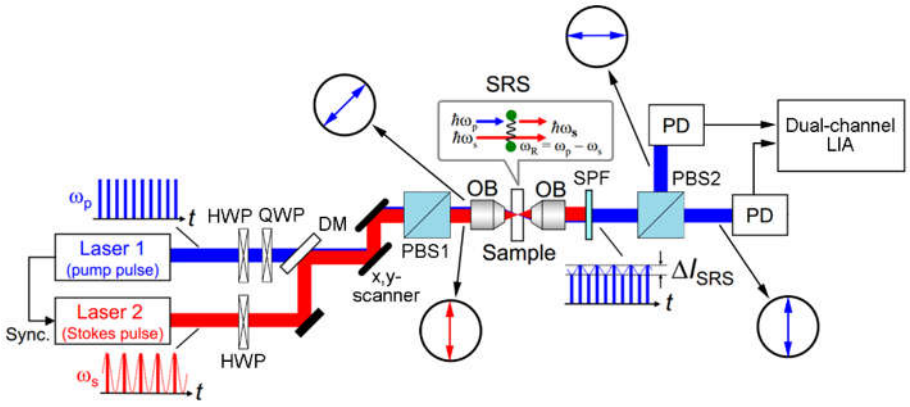

FIG. 1. Schematic of multicolor dual-polarization SRS microscopy. Basic phenomenon of SRS is illustrated inside the dialog box. The input and output pulse trains are depicted in the time domain. Polarization states are shown with arrows in circles. HWP, half-wave plate; QWP, quarter-wave plate; DM, dichroic mirror; PBS, polarizing beam splitter; OB, objective; SPF, short-pass filter; PD, photodiode; LIA, lock-in amplifier.

Reference

[1] F. Munhoz, S. Brustlein, R. Hostein, P. Berto, S. Brasselet, and H. Rigneault, J. Raman Spectrosc. **43**, 419 (2012).

[2] Z. Wang, W. Zheng, C. Y. S. Hsu, and Z. Huang, Appl. Phys. Lett. **108**, 033701 (2016).