Spatial light-modulated stimulated Raman scattering microscopy for rapid multiplexed vibrational imaging

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Abstract

We report the development of a unique spatial light-modulated stimulated Raman scattering (SLM-SRS) microscopy that tailors the broadband excitation beam with sparse-sampling masks designed for rapid multiplexed vibrational imaging. The optimal mask pattern enabling the selection of predominant windows in SRS spectrum allows a collective excitation at the highest possible peak power, providing an improved signal-to-noise ratio (SNR) without compromise of chemical specificity. Further, the pulse-shaping module designed contains a flexible spatial light modulator to offer dual functions whereby spectral patterning of sparse-sampling masks and rapid acquisition of SRS spectrum for mask generation can be facilitated to make the SLM-SRS system a standalone imaging platform. We demonstrate that SLM-SRS technique permits rapid multiplexed SRS imaging of polystyrene and poly (methyl methacrylate) beads in Brownian motion and monitors the functional response of live cells and in vivo penetration of dimethyl sulfoxide into the plant tissue, affirming the broad applicability of SLM-SRS microscopy for rapid observations of dynamic processes in biological systems at the subcellular level.

Reference

[1] Bae Kideog, Wei Zheng, and Zhiwei Huang*, Spatial light-modulated stimulated Raman scattering (SLM-SRS) microscopy for rapid multiplexed vibrational imaging, Theranostics 2020; 10(1):312-322. doi:10.7150/thno.38551.