SUPER-RESOLUTION RAMAN MICROSCOPY BY SELECTIVE DEPLETION OF STIMULATED RAMAN SCATTERING WITH ENGINEERED POLYYNES

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KEY WORDS: Super-Resolution, Multiplexed Image, Stimulated Raman Scattering, Raman Microscopy

Stimulated Raman scattering (SRS) microscopy is an emerging imaging tool for biological systems probing intrinsic vibrational frequencies of chemical bonds. However, optical diffraction limits its spatial resolution. We introduced a super-resolution SRS microscopy based on selective suppression of SRS by another competing SRS in a three-beam SRS instrument with one common pump beam. In this scheme, the depletion efficiency and spatial resolution depend on the Raman cross-sections of the two competing Raman-active modes. To maximize the resolution enhancement effect, we used phenyl-capped polyynes with two strong Raman-active modes. With diphenyl butadiyne, the vibrational mode of conjugated double bonds at 1595cm^{-1} is detected while the C≡C stretching mode at 2217cm^{-1} is used as the depletion mode With the maximum depletion power of 0.75 TW/cm^2 at 1030 nm, the expected resolution is about 4 times enhanced compared with the diffraction limit. By increasing the number of C≡C bonds, we adjust the Raman cross-sections of the detection and depletion modes and investigate their effects to the depletion efficiencies and the spatial resolutions.