

Radial Polarization Coherent Anti-Stokes Raman Scattering Microscopy Facilitates Detection of Longitudinally Oriented Molecules

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Coherent anti-Stokes Raman Scattering (CARS) microscopy has emerged as a powerful imaging tool for label-free, real-time and nonperturbative molecular imaging of live cells and tissues with high chemical sensitivity and specificity [1, 2]. Polarized CARS imaging has been used for probing molecular orientations in the samples, but most work centers on applying linearly polarized excitation fields for sensing the molecule alignments along the lateral directions of the samples [3]. Recently, radially polarized light beam receives much interest owing to its potential utilities in optical trapping, lithography, microscopy and optical data storage. Tightly focusing of radially polarized beam resulting in a strong longitudinal (axial) field component has been applied for three-dimensional molecular imaging in fluorescence microscopy, second harmonic generation (SHG) and third harmonic generation (THG) [4]. In this work, we report a novel CARS imaging technique by utilizing radially polarized excitation light fields to facilitate the sensitive detection of longitudinally oriented biomolecules in the samples. Figure 1 shows the comparison of radial polarization CARS images of the 20-micron plant veins sectioned: (a) perpendicular to the vein fibers, and (b) parallel to the vein fibers. The averaged intensity of Fig. 1(a) is approximately 2-fold higher compared to Fig. 1(b), demonstrating that radial polarization CARS imaging effectively enhances the detection sensitivity for longitudinally oriented molecules. Further studies also indicate that radially polarized CARS microscopy improves lateral resolutions for molecular imaging.

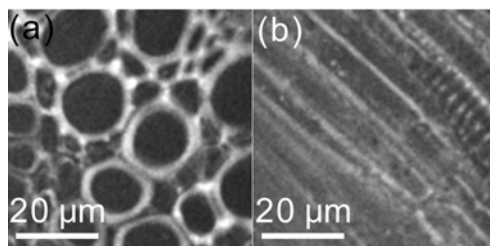


Figure 1: Radial polarization CARS images of 20-micron plant veins sectioned: (a) perpendicular to the vein fibers, and (b) parallel to the vein fibers.

References

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