Novel Polarization Sensitive Contrast Agents for Optical Coherence Microscopy
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Optical coherence microscopy (OCM) has advantage of high penetration depth and high sensitivity compared to conventional confocal microscopes. Despite of these advantages OCM has limited applicability in molecular imaging application, as OCM is inherently structural imaging modality. Conventionally used fluorescent molecules can not be applied into OCM as fluorescence is an incoherent process. To extend the applicability for molecular imaging, several probes are developed. Due to its high scattering, high absorption, tunable resonance wavelength, non-toxic in biological tissues, gold nanoparticles have become widely used contrast probes for coherence imaging methods.

As it is not possible to differentiate a signal of gold nanoparticles from the background signal, they have poor signal to background ration leading into weak contrast. Applicability of conventional gold nanoparticles is limited by poor contrast offered by them, so we proposed a method to use a dual-rod gold nano-structure as a polarization sensitive contrast agent to enhance the contrast of optical coherence tomography [1]. In the previous work, we had demonstrated that chiral nanostructure can provide efficient background signal rejection leading into better contrast.

In our current work we have fabricated chiral nanostructure. We modified conventional OCT system to efficiently reject background signal and to obtain polarization dependent signal. To experimentally demonstrate improvement in contrast, we imaged array of chiral nanostructure.

In the Fig. 1 (a and b) we have shown the images obtained with Left and Right circularly polarized light illumination. We can see that due to strong background signal it is difficult to identify the signal from the nanoparticles. With our modified system we obtained differential contrast signal (Fig. 1(c)), we can clearly see efficient rejection in the background signal leading into great improvement in the contrast.

Fig. 1 Chiral nanoparticle image (a) with Right-circular illumination, (b) with Left-circular illumination, and (c) Differential contrast image.