was measured separately and the PL intensity as a function of the polarization angle relative to the long axis of the Ag NW is displayed in Fig. 6. It could be observed that, for either parallel or perpendicularly polarized excitation, the strongest (or weakest) PL intensity was always observed in the parallel (or vertical) polarization direction with the excitation laser, which could be explained that the longitudinal (or transverse) SPP mode was mainly excited in the parallel (or vertical) polarization laser direction. The PL intensity variation was dependent on the polarization direction of the excitation laser linearly. The PL polarization feature could be characterized by the polarization contrast *P* as

$$P = \frac{I_{\parallel} - I_{\perp}}{I_{\parallel} + I_{\perp}} \tag{1}$$

where I_{Π} and $I_{\perp}$ are the PL intensity under the parallel and vertical directions related to the polarization directions of the excitation laser, respectively. According to the experimental data shown in Fig. 6, the polarization contrast for the parallel and perpendicular polarized incident light was about 0.88 and 0.70, respectively. This indicates that the PL intensity from a single Ag NW is spatially more polarized when the incident polarization is along the long axis of the Ag NW.

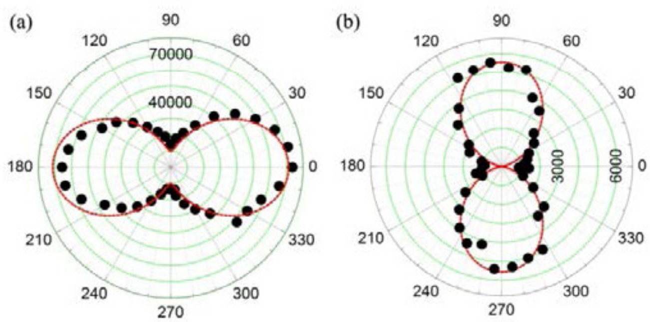

Fig. 6. The PL emission polarization from a single Ag NW under different excitation laser polarization directions: (a) parallel and (b) perpendicular. The red solid curves are a fit.

4. Conclusion

In summary, we have observed that the PL from a single Ag NW was very sensitive to the polarization direction of incident excitation light and varied with a period of 180°, which was in good agreement with the results of FDTD simulation. Strong avalanche PL from a single Ag NW was found when the polarization direction of incident light was along the length axis of single Ag NW due to strong surface plasmon coupling effect. The emission polarization investigation indicated that the spatial distribution of the PL intensity was polarization sensitive. The polarization feature of the PL from a single Ag NW plasmonic waveguide may be useful in applications of nanophotonics, polarization-dependent image, sensing and biolabeling.

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