

Supporting Information

Loss-favored ultrasensitive refractive index sensor based on directional scattering from a single all-dielectric nanosphere

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Morphology and structure characterization of Te nanoparticles.

Figure S1 shows the typical morphology and structure characterization of Te nanoparticles prepared by ns-LAL. It can be seen that the synthesized nanoparticles exhibit a wide size distribution, as shown in Figure S1a. After the statistics by Nano Measurer 1.2 software shown in Figure S1b, we obtained the statistical histogram of the particle sizes and its Gaussian fitting curve in Figure S1c. The x-ray diffraction (XRD) pattern of shown in Figure S1d indicates the hexagonal polycrystalline structure of the synthesized Te nanoparticles. Additional detailed microscopic morphology and structure results of the Te nanoparticles were analyzed by transmission electron microscopy (TEM). Figure S1e is the TEM image of a Te nanoparticle (about 150 nm). Figure S1 f-h represent its corresponding high-resolution TEM (HRTEM) image, selected-area electron diffraction (SAED) pattern. The HRTEM analysis of the lattice fringes indicates that there are several crystal orientations coexisting in one nanoparticle. Figure 1f and g show that the interplanar spacing of the nanocrystal is 0.235 and 0.206 nm, which are in good agreement with the value of (102) and (111) of the hexagonal Te structure.

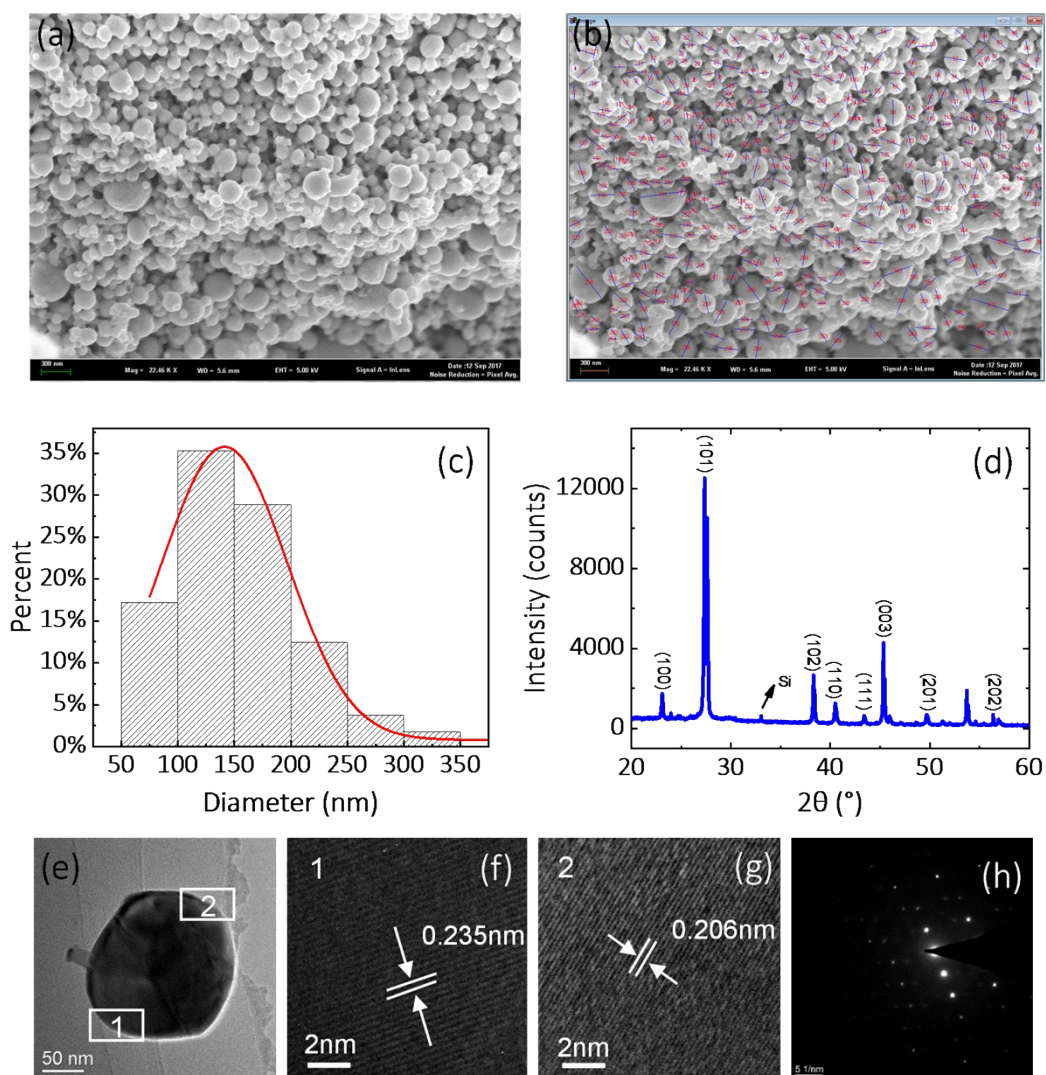


Figure S1. Typical morphology and structure characterization results of Te nanoparticles prepared by ns-LAL. (a) SEM image of Te nanoparticles. (b) Measurements of particle sizes. (c) The statistical histogram of the particle sizes. (d) XRD pattern of the Te nanoparticles deposited on a Si substrate. (e) TEM image of a Te nanoparticle. (f), (g) Corresponding HRTEM micrographs. (h) SAED pattern of the Te nanoparticle.

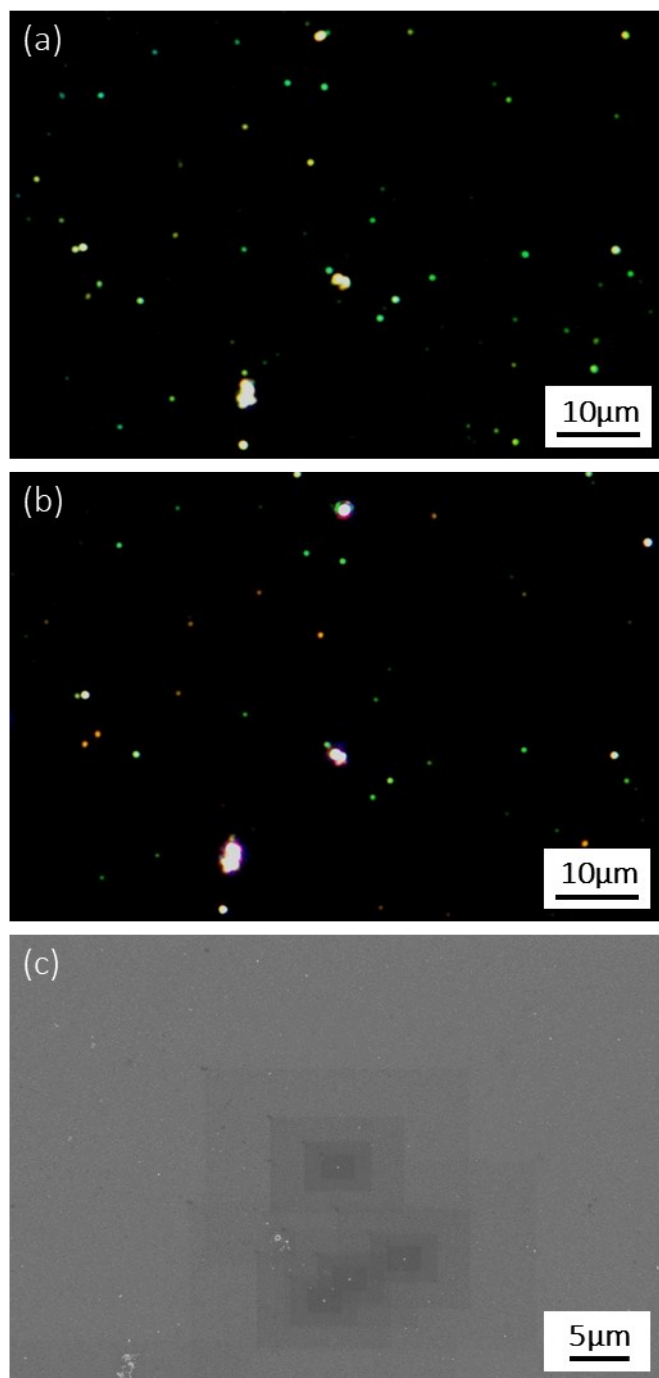


Figure S2. The dark-field images of the same Te nanospheres in the (a) forward scattering and (b) backward scattering measurements. (c) The corresponding SEM image.

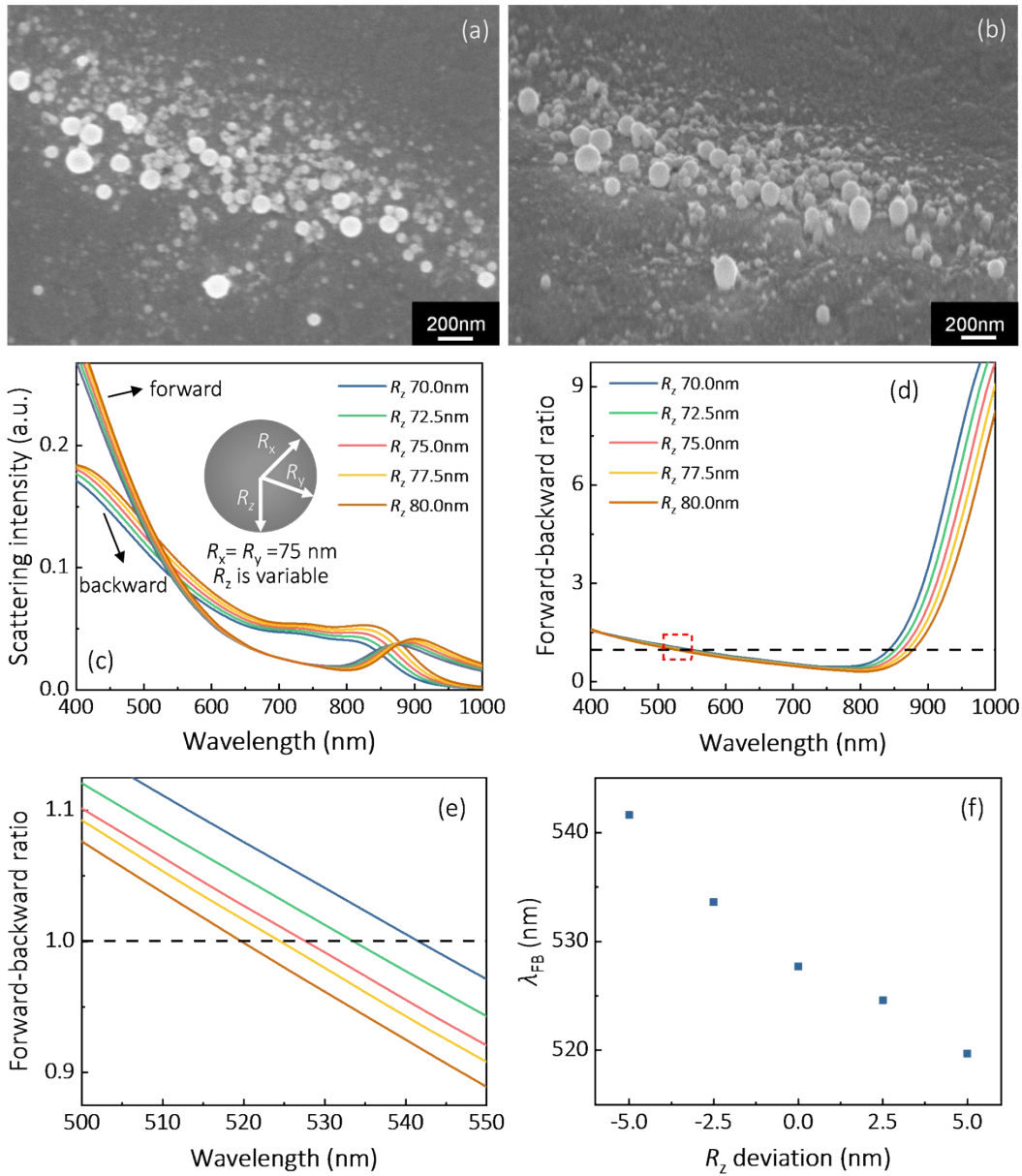


Figure S3. Influence of the shape of Te nanoparticles on their spectral properties. (a) The top and (b) 54°-tilted view SEM images of Te nanoparticles. (c-e) Calculation results of the forward and backward scattering and forward-to-backward ratio for Te nanoparticles with $R_z = 70.0, 72.5, 75.0, 77.5$ and 80.0 nm, respectively. The inset in (c) is the schematic representation of a spheroidal nanoparticle with $R_x = R_y$, and varied R_z . R_x and R_y are fixed at 75 nm. (f) λ_{FB} vs R_z deviation of the Te nanoparticles.

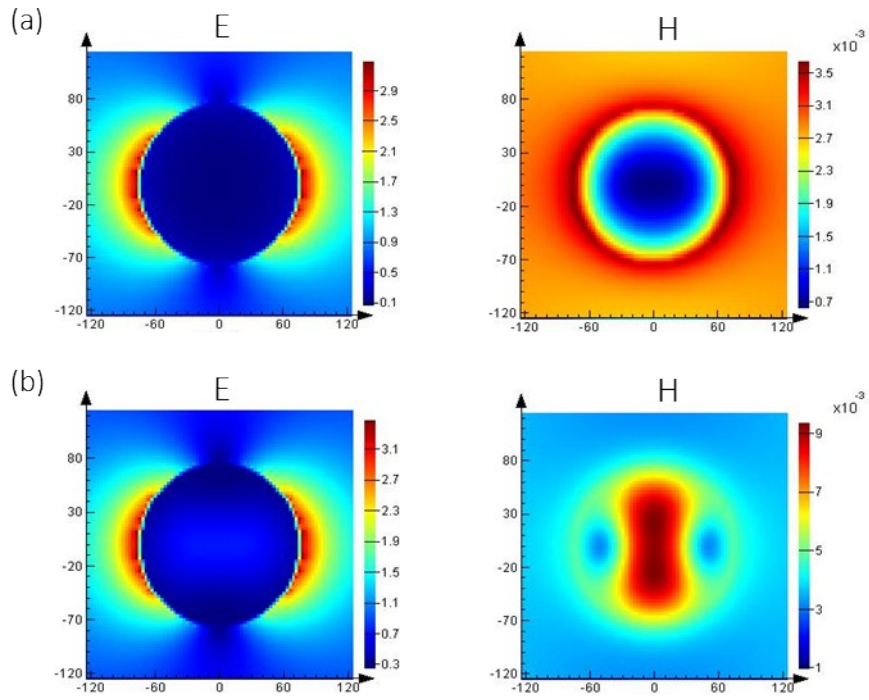


Figure S4. The near-field distributions of Te nanospheres at wavelength (a) $\lambda_{\text{FB,air}}$ and (b) $\lambda_{\text{FB,water}}$ in Figure 3c.

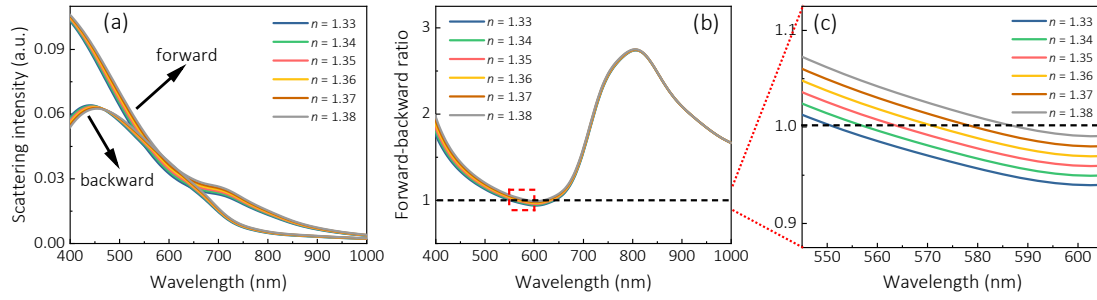


Figure S5. RI sensors based on a single Te nanosphere ($d = 100$ nm). (a) The simulated forward and backward scattering spectra of the Te nanosphere immersed in RI environments ranging from 1.33 to 1.38. (b), (c) Forward-backward scattering ratios of the Te nanosphere.

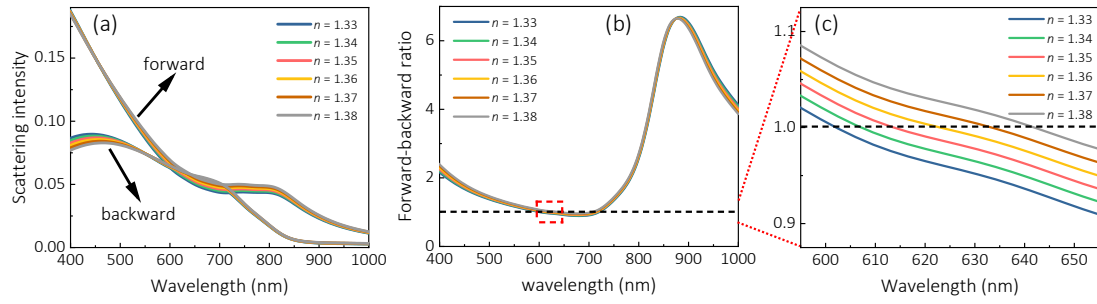


Figure S6. RI sensors based on a single Te nanosphere ($d = 125$ nm). (a) The simulated forward and backward scattering spectra of the Te nanosphere immersed in RI environments ranging from 1.33 to 1.38. (b), (c) Forward-backward scattering ratios of the Te nanosphere.

Figure S7. The simulated forward and backward scattering spectra of (a) Si and (b) Ge nanospheres with diameters of 150 nm immersed in different RI environments.

