

Rotational anisotropy of optical second harmonic generation from Pt nanowires with boomerang-like cross-sectional shapes

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The nonlinear optics of metallic nanowires is a subject of increasing interest because of the strong anisotropy due to the electronic confinement. Nonlinear optical phenomenon such as second-harmonic generation depends strongly on the symmetry of the structure of the medium. Previously, we measured SH intensity from a C_s -symmetric Pt nanowire array on a faceted MgO(110) substrate. Their cross-sectional shapes were observed by transmission electron microscope (TEM). Then the investigation of SH response from nanowires of other cross-sectional shapes have become desirable. In this research we have observed C_{2v} -symmetric Pt nanowires with the cross sections of boomerangs by TEM and investigated the SH signal from them.

Pt nanowires on the faceted MgO(110) substrates were fabricated by a shadow deposition technique in UHV of 9.5×10^{-7} Pa. From both hand sides of a faceted MgO template, oblique deposition of Pt (2nm) was performed. After fabrication of the Pt nanowires, a very thin (80 μ m) part of a flake with MgO(001) faces and the nanowire cross-sections was observed by TEM. The probe-light pulses with a fundamental photon energy of 2.33eV was generated by a mode-locked Nd:YAG laser. The fundamental light was focused onto the sample with the incidence angle of 45°. The SH signal from the sample was observed.

Figure 1(a) shows a TEM image of the cross sections of Pt nanowires on the MgO(110) faceted template. According to the TEM image, the shapes of Pt were like boomerangs. The SH intensity in p -in/ p -out polarization configuration depends strongly on the rotation angle φ as seen in Fig.1(b). The SH pattern in s -in/ s -out polarization configuration was very weak. This is because the shapes of the metal cross sections have local mirror symmetry in direction 2.

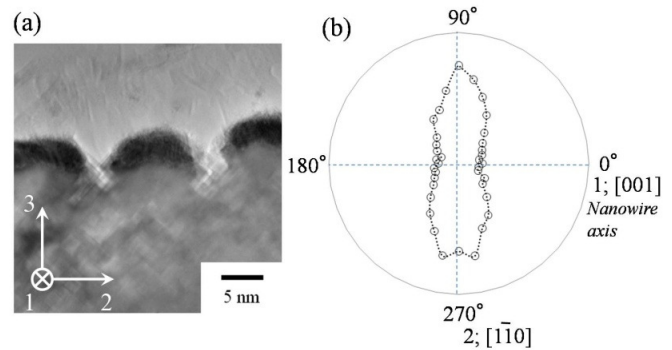


Fig.1(a) TEM image of Pt NWs, (b) SH intensity in p -in/ p -out polarization configuration