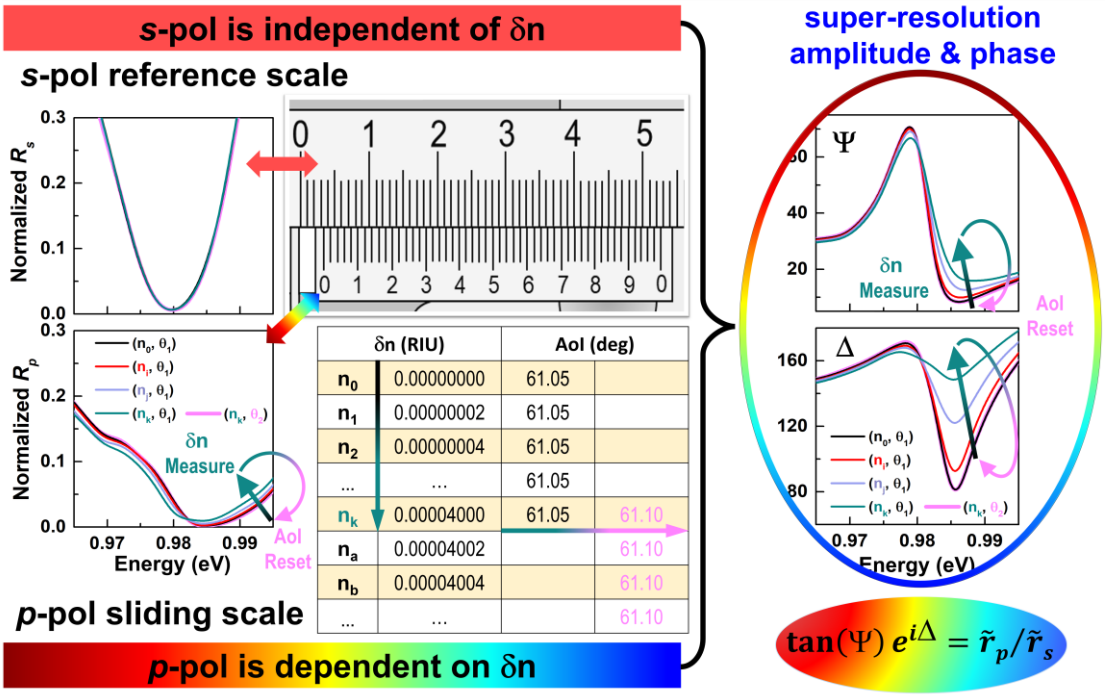
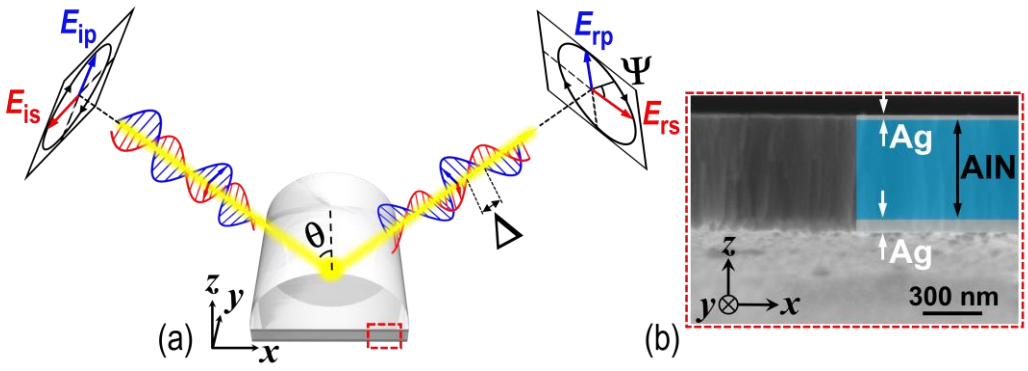
Title: Vernier Ellipsometry Sensing with Ultralow Limit-of-Detection and Large Dynamic Range by Tuning of Zero-Reflection Points



Simultaneous implementation of two orthogonally polarized ZRPs and spectral overlap of *s*-pol photonic modes with the coupled, *p*-pol resonances; and ellipsometry-based sensing where the relatively insensitive *s*-pol ZRPs provide internal references to boost the sensor performance in terms of the amplitude ratio (ψ) and phase difference (Δ) of the *s*- and *p*-polarized reflectance thereby naturally forming a refinement measuring scale akin to a Vernier scale. Remarkably, the precise manipulation of the double dark points (R_p and R_s) via the AoI control enables a second metric that yields ultrahigh sensitivity and can be reset to the original spot over a large dynamic range. This capability is enabled because the topologically protected zeros can consistently exist by simply adjusting the AoI.



(a) Schematic of the total internal reflection ellipsometry measurement geometry, which provides both amplitude ratio (Ψ) and phase (Δ) information of the reflected light. (b) SEM cross-section image of the fabricated Ag (20 nm)/AlN (500 nm)/Ag (48 nm) multilayer that used in our experiment.