The substrate effect in electron energy-loss spectroscopy of localized surface plasmons in gold and silver nanoparticles - DTU Orbit (18/09/2019)

The substrate effect in electron energy-loss spectroscopy of localized surface plasmons in gold and silver nanoparticles

Electron energy-loss spectroscopy (EELS) has become increasingly popular for detailed characterization of plasmonic nanostructures, owing to the unparalleled spatial resolution of this technique. The typical setup in EELS requires nanoparticles to be supported on thin substrates. However, as in optical measurements, the substrate material can modify the acquired signal. Here, we have investigated how the EELS signal recorded from supported silver and gold spheroidal nanoparticles at different electron beam impact parameter positions is affected by the choice of a dielectric substrate material and thickness. Consistent with previous optical studies, the presence of a dielectric substrate is found to redshift localized surface plasmons, increase their line-widths, and lead to increased prominence of higher order modes. The extent of these modifications heightens with increasing substrate permittivity and thickness. Specific to EELS, the results highlight the importance of the beam impact parameter and substrate related Čerenkov losses and charging. Our experimental results are compared with and corroborated by full-wave electromagnetic simulations based on the boundary element method. The results present a comprehensive study of substrate induced modifications in EELS and allow identification of optimal substrates relevant for EELS studies of plasmonic structures.

General information
Publication status: Published
Organisations: Center for Electron Nanoscopy, Department of Photonics Engineering, Structured Electromagnetic Materials
Contributors: Kadkhodazadeh, S., Christensen, T., Beleggia, M., Mortensen, N. A., Wagner, J. B.
Pages: 251-261
Publication date: 2017
Peer-reviewed: Yes

Publication information
Journal: ACS Photonics
Volume: 4
Issue number: 2
ISSN (Print): 2330-4022
Ratings:
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 7.03 SJR 3.376 SNIP 1.689
Web of Science (2017): Impact factor 6.88
Web of Science (2017): Indexed yes
Original language: English
Keywords: Electron energy-loss spectroscopy, Substrate, Localized surface plasmons, Silver, Gold
Electronic versions:
ACSPhotonics_MS_sk_2016_Final_December.pdf. Embargo ended: 03/01/2018
DOIs:
10.1021/acsphotonics.6b00489
Source: FindIt
Source ID: 2350672776
Research output: Contribution to journal › Journal article – Annual report year: 2017 › Research › peer-review