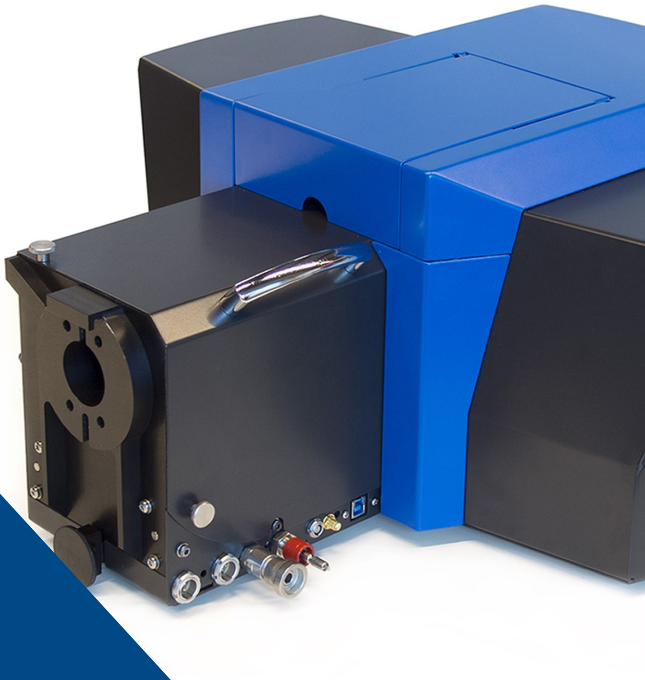

S P A R C

application note

Plasmonic Nanoantennas

delmic

SPARC

application note

Plasmonic Nanoantennas

Optical nanoantennas have the ability to control the emission, absorption, and scattering of light at the nanoscale [1]. Nanoantennas are often composed of metals such as gold, silver, or aluminium that support plasmonic resonances in the visible/ultraviolet/near-infrared spectral regime, and which can be tuned by varying shape and size.

Nanoantennas are promising for a large variety of applications. Their light-harvesting and light-directing properties can be used in:

+ anti-reflection coatings and light trapping in solar cells,
+ spontaneous emission control,
+ nanoscale sensing,
+ low-threshold steam generation,
+ localized heating for targeted medicine and fast-writing in magnetic hard disks,
+ color filters for CMOS imaging sensors,
+ surface-enhanced Raman scattering.

SPARC

Due to their nanoscale nature, characterization of plasmonic nanoantenna properties poses a challenge in itself. By using the SPARC cathodoluminescence (CL) system one is able to retrieve optical properties with deep-subwavelength resolution, including:

+ measuring the spectral and spatial distribution of plasmon resonances in a structure with nanoscale spatial resolution,
+ measuring the angular profile to study directionality,
+ measuring the polarization of emission.

An example of how the SPARC can be used in the context of antennas is shown in Figure 1.

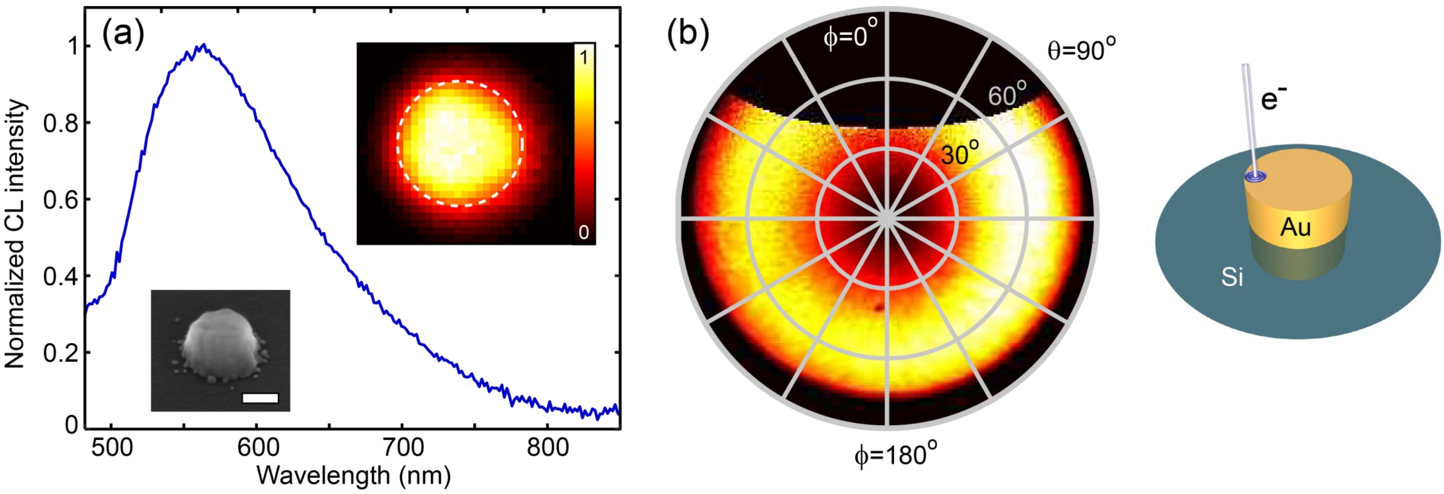

Figure 1 *(a) Normalized CL spectrum for a Au nanodisk on Si with a diameter of 100 nm and a height of 80 nm. An SEM image is shown as an inset (scale bar: 50 nm). The spectrum is taken by averaging the CL spectrum over the particle. A two-dimensional CL excitation map at λ_0 = 560 nm is shown as an inset. The dashed lines indicate the edge of the structure taken from the SEM image. (b) Normalized CL intensity as function of azimuthal (θ) and zenithal (φ) angles taken at λ_0 = 600 nm for excitation on the left side of the structure. The geometry is indicated by the diagram at the right [2].*

References

1. L. Novotny, and N. van Hulst. *Antennas for light.* Nat. Photon. **5**, 83–90 (2011).
2. T. Coenen et al. *Directional emission from a single plasmonic scatterer.* Nat. Commun. **5**, 3250 (2014).

DELMIC B.V. is a company based in Delft, the Netherlands that produces correlative light and electron microscopy solutions. DELMIC's systems cater to a broad range of researchers in fields ranging from nanophotonics to cell biology.

The SPARC is a high-performance cathodoluminescence detection system produced by DELMIC. The system is designed to optimally collect and detect cathodoluminescence emission, enabling fast and sensitive material characterization at the nanoscale.

For questions regarding this note, contact our SPARC Application Specialist at: coenen@delmic.com

For more SPARC application notes, see: delmic.com/sparc/application_notes.php

For more information on the SPARC, visit: delmic.com/sparc

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