

RSoft Application: Plasmon Nano Probe

For Semiconducting Nanodevices and Biochemical Sensors

Overview

SPM (Scanning probe microscopy) nanoprobes have been increasingly required for the electrical evaluation of semiconducting nanodevices, biochemical measurement of DNA and protein molecules, as well as nanoscale material property investigations. A U.S. microscope manufacturer and several research organizations in Japan and China have requested investigations of surface plasmon enhanced metallic nanoprobe behavior in various conditions.

The Challenge

- ▶ To obtain a strong enhancement effect, the plasmon resonance wavelength (PRW) of the metallic probe and the excitation wavelength need to be spectrally matched with each other.
- ▶ Considering the cost and limited number of laser sources, it is necessary to achieve the right combination and size of Si/SiO₂ in the probe tip to guarantee the best PRW match.

The Solution

RSoft™ FullWAVE™, based on the FDTD method, is suitable for simulating nano-scale devices and surface plasmon effects. FullWAVE's enclosed launch feature allows for measurement of the probe's scattering-only properties.

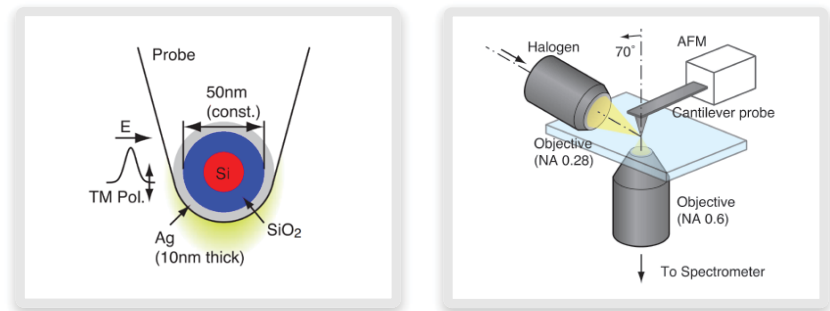


Figure 1. Diagrams of the Si probe and measurement setup.
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The Result

FullWAVE provided the PRW peak shift positions and scattering strength change with SiO₂ thickness. It was also used to investigate the impact of environmental index change to understand measurement sensitivity.

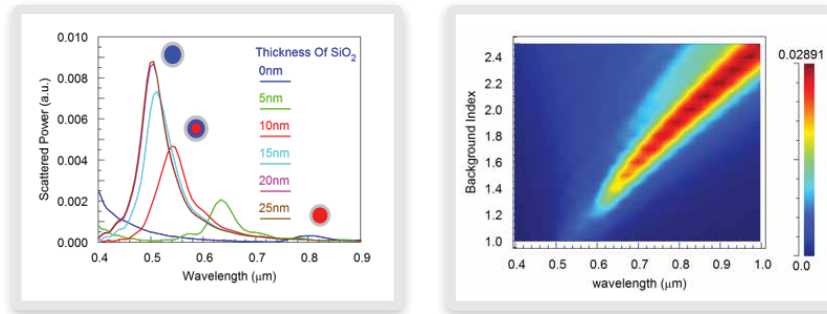


Figure 2. FullWAVE analysis results: a) Scattered power vs. wavelength for various SiO₂ thicknesses, and b) Scattered power vs. background index and wavelength.

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