Table of Contents

TERS field enhancement

There are many different results in the literature related to TERS probes. Most typically, the probe is simulated for a single wavelength, using a truncated probe apex and plane wave illumination. This is an easy way how to demonstrate the local field enhancement. However, there are few potential problems:

Even for truncated probe, some antenna effect can be expected (ideally infinitely extending probe is hard to be simulated). Truncated probe is still far from reality as in real experiments, the probe is large, much larger than what can be simulated unless we make the model consisting of really large voxels, losing some spatial resolution (there is a tradeoff between the detailness of model and its size). Staircasing effect can create some extra errors, namely for coarse models.

Nevertheless, we can simulate all the typical effects observed at TERS probes. We focused on aluminium coated silicon probes and first wanted to separate different competing effects, as follows The smaller the tip radius is the bigger is the enhancement. The bigger is the thickness of aluminium layer, the bigger is the enhancement in our spectral region of interest

A series of numerical experiments was done to see these effects separately and combined. First, probes from solid aluminium were simulated, having different radii. Second, probes with the same total radius were simulated, having different thickness of the aluminium layer (so the silicon core radius) was changing appropriately. Finally, the most realistic case which are probes with silicon core of some radius with thin film of varying thickness on top was simulated. The simulations were peformed for different wavelengths and also for different materials of the core.

Sample parameter file: TERS.
A 300x300x300 computational domain with TERS tip