Deep-UV Plasmonics for Nanophotonics and Nanoimaging

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Ultraviolet (UV) and deep-ultraviolet (DUV) cover an interesting spectral range where short wavelength and high photon energy can lead to new information in microscopy and spectroscopy as well as to improved applications of photocatalytic effects, solar cells and lithography. While short wavelength can intrinsically lead to better spatial resolution in microscopy, an inclusion of plasmonic effects in UV-DUV can result in much higher spatial resolution in microscopy and nanoscopy than what we expect in the visible range. However, even though the advantages of the UV-DUV spectral range have been recognized for a long time, there has been only limited effort to explore the plasmonics in DUV towards its applications in spectroscopy at nanoscale, in high-resolution microscopy, and in many other related fields.

Here, I will present our recent work on developing the plasmonics in the UV-DUV range. We found that aluminum works as a metal for plasmonics in DUV [1, 2], where gold and silver—the predominant choice of metals for plasmonics in visible region—behave dielectrics but not metals. Using aluminum tip, we have successfully demonstrated the plasmonic tip enhancement of DUV resonance Raman scattering of biomolecules [1]. We have applied DUV resonance Raman to the visualization of nucleic acids in biological cells [3]. Besides aluminum, indium was found to be another promising plasmonic metal in DUV [4]. The material properties of those metals will be discussed. The application of DUV plasmonics to the related fields such as photocatalysis will be also presented [5].

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