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Nanoplasmonics: Enabling Platform for Integrated Photonics and Sensing

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Strong interactions between electromagnetic radiation and electrons at metallic interfaces or in metallic nanostructures lead to resonant oscillations called surface plasmon resonance with fascinating properties: light confinement in subwavelength dimensions and enhancement of optical near fields, just to name a few [1,2]. By utilizing the properties enabled by geometry dependent localization of surface plasmons, metal photonics or plasmonics offers a promise of enabling novel photonic components and systems for integrated photonics or sensing applications [3-5]. The versatility of the nanoplasmonic platform is described in this talk on three folds: our findings on an enhanced ultracompact photodetector based on nanoridge plasmonics for photonic integrated circuit applications [3], a colorimetric sensing of miRNA based on a nanoplasmonic core-satellite assembly for label-free and on-chip sensing applications [4], and a controlled fabrication of plasmonic nanostructures on a flexible substrate based on a transfer printing process for ultra-sensitive and noise free flexible bio-sensing applications [5].

For integrated photonics, nanoplasmonics offers interesting opportunities providing the material and dimensional compatibility with ultra-small silicon electronics and the integrative functionality using hybrid photonic and electronic nanostructures. For sensing applications, remarkable changes in scattering colors stemming from a plasmonic coupling effect of gold nanoplasmonic particles have been utilized to demonstrate a detection of microRNAs at the femtomolar level with selectivity. As top-down or bottom-up fabrication of such nanoscale structures is limited to more conventional substrates, we have approached the controlled fabrication of highly ordered nanostructures using a transfer printing of pre-functionalized nanodisks on flexible substrates for more enabling applications of nanoplasmonics.

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