Nanoplasmonic TEM Sample Design with Full Location- and Chemistry Control

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Surface plasmons are collective electron oscillations taking place at the surface of metallic materials. When we pattern the surface of a material at the nanoscale or change its chemical properties, the plasmon oscillation frequency is locally changed, and with it, the materials' optical response [1]. This effect has been reproducibly demonstrated with monochromated electron energy-loss spectroscopy (EELS) experiments [2-5].

In order to engineer surface plasmons for novel applications, various protocols have been developed to controllably design metals at the nanometer length scale. For example, the formation of novel metal nanoparticles via wet-chemical synthesis gives broad design freedom of the chemistry of the nanoparticles, but no control over their location [6]. Alternatively, thin-film patterning techniques are available that provide good control over the shape and location of the plasmonic structures, but no control over the chemistry - beyond that of the evaporator source [7-16].

Here, a new method is presented that combines the large-area location control of electron beam lithography [17-19] with the broad chemical control provided by colloidal chemistry [20], as summarized in Figure 1. Monochromated STEM EELS results will be presented, showing that this method opens the door to systematic nanoplasmonic studies with full design freedom.

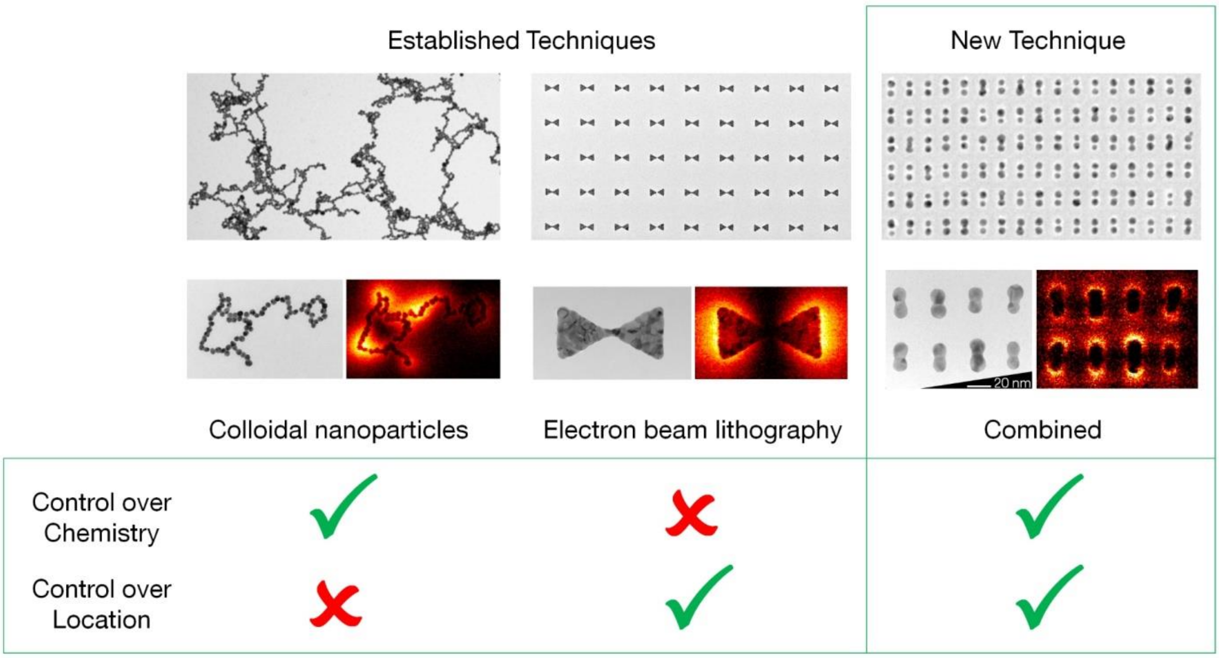

Figure 1. Until now, it has only been possible to either have good chemical control or good shape/location control over plasmonic surfaces. The here-presented new method combines both.

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