Plasmonic Cap Arrays for Real-Time Tunable SERS Substrate

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Surface plasmon (SP) is defined as oscillation of electrons at interface between metal and dielectric materials. Localized surface plasmon resonance (LSPR) induced from metal nanostructures strongly depends on their materials, geometries and surrounding environments. In this manner, precisely designed plasmonic substrates have been applied for label-free chemicals and biomaterials sensing. Several metal nanostructures have been suggested to optimize optical properties for higher sensitivity. However, geometrical features of previously reported plasmonic structures were fixed during preparation steps, so optical features could not approve further tunability. In this work, plasmonic cap arrays were fabricated on elastomeric substrate to overcome the above mentioned limitations. Plasmonic properties could be tuned by changing the gap distance between adjacent gold caps using mechanical manipulation leading to elastic deformation. Furthermore, plasmonic structures at stretched state exhibited highly enhanced Raman signal due to strong electro-magnetic field enhancement arose from decreased spacing between gold caps as hot-spots.