The usage of dielectric spacer layers between nanoparticles and a conducting surface significantly increased efficiency in many plasmonic devices, due to the induction of strong image dipole moments. However, spectro-electrochemical applications involving interfacial redox processes at the electrode are not possible on structures with an electrically sealing, continuous dielectric layer. We therefore modified this approach in a way that the dielectric spacer layer is present under the nanoparticles only, which therefore become double-layered nanoparticles comprising gold nanoparticles on top of dielectric tantalum pentoxide particles. The positions of multiple plasmon resonances induced in this structure can be tuned by varying the grating period and the size of the nanoparticles from the visual up to the mid-infrared region. We have demonstrated interfacial electron transfer at our substrate by measuring cyclic voltammograms of potassium ferricyanide. Further we proofed the existence of surface plasmons in the mid-infrared region using nanoparticles with diameters up to 600nm by measuring reflection spectra in the infrared region. The combination of these infrared plasmons with a self-assembled alkanethiol monolayer attached to the substrate revealed quantum mechanical coupling between the molecule vibrations and the plasmon excitations. We experimentally demonstrated that by tuning the spectral position of the plasmon resonance, infrared absorption of molecule vibrations can be suppressed or enhanced. While enhancement of the absorption is commonly used in surface enhanced infrared measurements, the suppression of molecule vibrations using plasmons may have far reaching consequences for the interpretations of surface enhanced infrared and Raman measurement. Potential applications of this phenomenon are under current investigation.