

# Refractometric sensitivity comparison between different nanoparticle structures towards optical fiber sensors

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Plasmonic nanoparticles (NPs) are known to show localized surface plasmon resonances (LSPR), whose optical properties depend on NPs size, geometry, material and inter-particle coupling [1], [2]. Their refractometric properties also depend on the light coupling conditions, being the prism-based configurations the most used [3]. Recently, LSPR excitation with optical fibers have shown interesting results, with reports of both low and high refractive index (RI) sensitivity (RIS) [4], [5].

Herein, a comparison between such reports is made for a common optrode configuration based on a decladded section of a multimode fiber (MMF) coated with gold NPs. Some reports analyze their RI response only in terms of amplitude, showing wavelength insensitive RI response, as reported in [6], or works that show unusually high wavelength shifts. Such example is shown by Jia et al., [7], reporting a RIS of 2016 nm/RIU, with gold nanospheres (NS) of 80 nm. This shows great diversity when compared to gold NS on planar substrates, where typical RIS range from 50 to 100 nm/RIU [3]. To date, the mechanisms behind this RIS variability are not well understood, with erroneous attributions to hot-spots or interparticle coupling [7]. On the other hand, Otte et al. [8] proposed that by treating the NP region as a uniform region, resulted in modified dispersion curves, leading to great effective RI, thus changing greatly the sensor RIS properties.

In this work we will compare gold and silver NSs and analyze their RIS properties for the same optrode configuration, as the works here cited. The NPs synthesized procedure will be discussed and compared by their material properties. Preliminary results presented an overall high RIS for all the gold nanospheres, reaching a maximum of 4186 nm/RIU for the 35 nm gold NSs. The highest RIS reported on such NP geometry. Moreover, a nonlinear RIS increase was also observed. These results presented a great RIS increase when compared to the obtained 82 nm/RIU for the same gold NS deposited on a glass slide.

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