Supporting Information

Plasmonic Mach-Zehnder Interferometer for Ultrasensitive On-Chip Biosensing

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Further optimization of the plasmonic MZI sensor performance.

FOM is a widely-accepted parameter employed to evaluate and compare the intrinsic sensor detection limit among different plasmonic sensing schemes,[13,15,34,37,38] but is admittedly not the only factor needed to further optimize the sensor performance for practical applications. Many other practical issues must be considered, one of which is the noise level of the sensor response. Although the FOM could be improved to 224 when L=69.0μm, as shown in Figure S1, one can see that the spectra signal-to-noise ratio and modulation depth are both decreased (compared with the spectra in Figure 4b) due to the higher SP propagation loss. Consequently, in the optimization of the device, L needs to be chosen carefully to balance this tradeoff between the FOM and the signal-to-noise ratio and to enhance the sensor detection limit (DL). The current optimized L value in this series of samples is ~57.6μm with a lowest DL of 1.2×10^{-5}RIU and a FOM of 193 (the MZI with L=69.0μm has a slightly higher DL of 1.5×10^{-5}RIU). This DL value is among the lowest reported for miniaturized plasmonic biosensors,[35,42] which, however, is still one to two orders larger than commercial prism-based SPR systems with temperature stabilization components. Further optimization, *e.g.*, using ultrasmooth metal film, developing advanced data analysis methods, introducing on-chip temperature control or reference channels to cancel the temperature-induced signal drift, is currently under investigation.

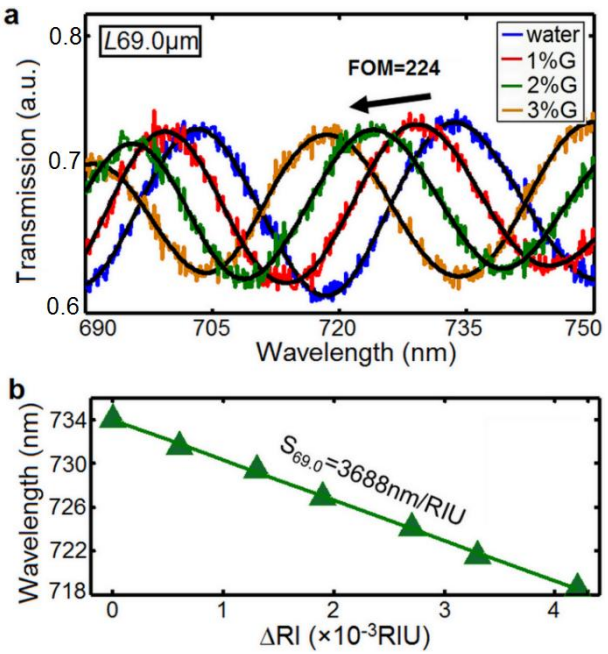

Figure S1. (a) Measured interference patterns for a plasmonic MZI with L=69.0μm. For clarity, only the spectra of water and 1%, 2%, and 3% glycerol-water solutions were shown. Black curves are guides to the eye. (b) Spectral positions of the interference peaks (indicated by the black arrow) *versus* the solution refractive index change.