4.2 Detection of BSA samples

Experimental transmission spectra for the MZI biosensor at different BSA solution concentrations (2 mg/mL, 1.7 mg/mL, 1.4 mg/mL, 1.1 mg/mL, 0.8 mg/mL, 0.5 mg/mL, 0.2 mg/mL) are shown in Fig. 5(a). It is evident the dip wavelength (denoted by a red asterisk "*") is shifted to shorter wavelengths at a distance of 68 nm corresponding to BSA concentration. This implies increasing BSA concentrations, even through slight RI changes between them. Quantitative data are presented in Fig. 5(b), which exhibit an excellent linear fit. The ultra-high wavelength sensitivity of −38.9 nm/(mg/mL) was obtained experimentally. The concentration DL for the MZI-based biosensor is calculated to be 2.57×10^{-4} mg/mL.

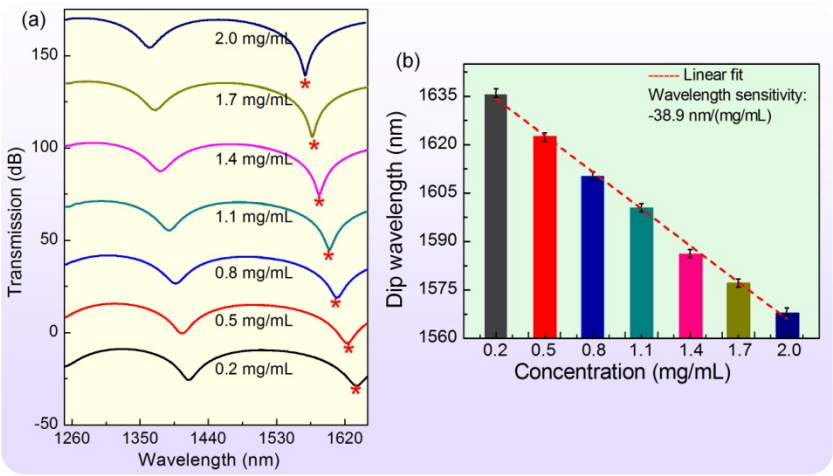

Fig. 5. (a) Transmission spectra evolution at different BSA concentrations. (b) Spectra shift dips at long wavelengths for different BSA concentration samples.

5. Conclusion

In summary, we have presented BSA concentration measurements acquired with a simple in-fiber MZI. The primary structure is a micro-cavity fabricated in the fiber core and cladding. Several micro-channels allow the biosensor to exchange information with surrounding media. A new fabrication technology involving chemical etching was utilized in this work. The minimum detectable RI variation (3.5×10^{-5} RIU), associated with an ultra-high RI sensitivity of −10,055 nm/RIU, allowed for differentiation of low BSA concentrations. A concentration sensitivity of −38.9 nm/(mg/mL) could be achieved with a low DL of 2.57×10^{-4} mg/mL. The MZI biosensor itself is simple, compact, and highly sensitive. As such, it is an excellent candidate for low-concentration BSA detection.

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