prior to use because the TFBG-SPR sensor has an internal thermometer provided by the absolute value of the Bragg wavelength of the core mode back reflection (completely insensitive to events surrounding the cladding). Measuring temperature at the same time as the SPR shift and using the calibrated residual temperature sensitivity of the sensor being used (+ 6.3pm/ °C here) allows temperature independent SPR shifts to be obtained. Obviously the RI of the material being measured also changes with temperature through its own thermo-optic coefficient but our calibrated sensor can provide an accurate RI reading for a material at the measurement temperature without contamination of the data by the temperature dependence of the sensor itself, a major issue in most SPR sensing schemes.

4. Conclusion

Using experimental results for the refractive index sensitivity of a single mode fiber TFBG-SPR sensor in water at different temperatures, and the self-referencing feature of the TFBG with temperature, we have demonstrated that the residual temperature dependence of the SPR shift measurement can be calibrated to + 6.3 pm/ °C at 1550nm in the temperature range from 23 °C to 59 °C. We further presented an elementary analysis of the origin of this residual sensitivity by calculating the temperature dependence of a "pure" plasmon at a single interface between gold and water. The experimental result differs from the theory by a factor of 12, likely because the thermo-optic properties of the very thin gold film used differ notably from those of bulk gold material. However, having provided a calibrated value for the residual temperature dependence of the SPR shift provides a way to remove this effect from any measurements since the core mode reflection wavelength of the TFBG can measure the temperature at the sensor location with great accuracy (typically 0.1°C), without influence from the outer medium refractive index. Therefore, we believe that a properly calibrated single mode fiber TFBG-SPR sensor can be used as an in situ biochemical sensor with truly temperature-independent results.

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