4.2 Discussion

Compared with the FBG or LPG based transverse load sensors that have the highest transverse load sensitivity of ~1 nm/N [16], the micro-cavity transverse load sensor shows a higher sensitivity of 1.37 nm/N. If no temperature compensation is used, the error caused by temperature cross-sensitivity will be about 1.5×10^{-3} N/°C. This may be neglected in applications in which large transverse load is involved. The micro-cavity sensor is similar to a point-contact load sensor and the high sensitivity is believed to be caused by the large pressure created by the load on the small contacting area. Hence, appropriate package is important for the senor to maintain the high transverse load sensitivity in practical applications.

5. Conclusion

In summary, a compact fiber-tip micro-cavity sensor was fabricated by use of the electric arc discharge to melt a section of capillary which is spliced to a single mode fiber end. The micro-cavity sensor demonstrated an interference fringe visibility exceeding 15 dB. The sensor can work a three-wave interference mode or a two-wave interference mode. In the three-wave mode, a temperature sensor with good repeatability up to 1000 °C was demonstrated. In the two-wave mode, a transverse load sensor with a high sensitivity of ~ 1.37 nm/N and a low temperature sensitivity of ~ 2.1 pm/°C was demonstrated. The sensor is tiny and works in a reflection mode, and hence may be used in space-limited environment.

In addition, refractive index sensing may be implemented by filling the air-cavity with the target liquid through for example a hole dilled transversely [7]. The micro-cavity sensor may also be used as a sensitive pressure detector if the outer silica wall could be made thinner using for example wet etching [17]. The good high temperature performance and mechanical strength means that the micro-cavity sensor may be used as gas/liquid pressure sensor in harsh (high temperature) environment. We are currently working along this direction.

Acknowledgements

The work was supported by the Hong Kong SAR government through grant PolyU5196/09E and the Hong Kong Polytechnic University through grant J-BB9K.

#140976- $15.00USD Received13 Jan2011;revised9 Mar 2011;accepted21 Mar 2011;published13 Jun2011