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Long Period Grating Single Mode Fiber - Tapered LPG Device as Refractive Index Sensing

What

is Long Period Gratings?

Nowadays, optical fiber sensors have been frequently used in place of electrical sensors due to their many advantages such as sensitivity, low cost, immunity to electromagnetic interference, etc. Amongst the most common type of fiber sensors developed are grating based sensor as they easy to manufacture and has multiplexing capability.

In this project, we have chosen to use a tapered single mode long period grating to sense refractive index change of the ambient fluid as LPG is known to couple light from the core to the cladding and hence sensitive to the refractive index change of the surrounding medium as shown in Figure 1

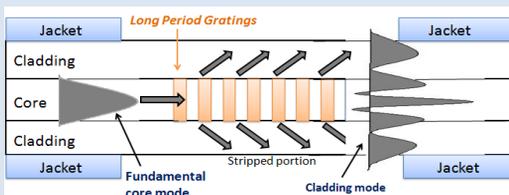
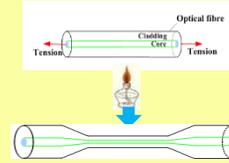


Figure 1: Mode conversion in a long period gratings fiber

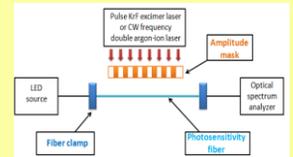
How

to fabricate tapered LPG?



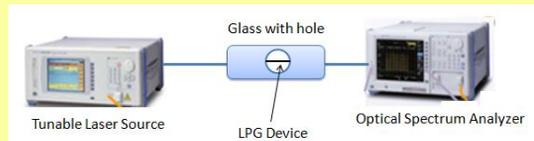
Step 1: Fabrication of a photosensitive single mode fiber using flame-heated taper drawing technique.

Step 2: Writing of LPG using an amplitude mask and a KrF excimer laser.

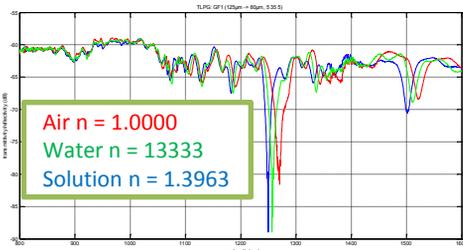


Step 3:

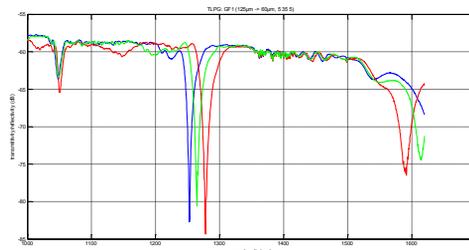
- The TLPG are encapsulated between 2 glass pieces.
- The device is dipped into ionized water and salt solution.
- The transmitted spectrum are observed using an optical spectrum analyzer.



Results and Discussion



Air-water :
28.8288nm/RI
Water-solution:
49.4574 nm/RI
Air-solution:
158.7302 nm/RI



Air-water :
70.807nm/RI
Water-solution >
76.1905nm/RI
Air-solution >
71.663 nm/RI

In conclusion, TLPG is a new type of grating based sensor that shows extremely high sensitivity to changes in the refractive index of the ambient medium. This discovery has great application potentials in engineering and biomedical devices. More detailed work will need to be conducted to test TLPG with smaller diameters or other fabrication method to optimize the sensor configuration.