LIM Jun Long – Design and Analysis of Solid-Core Microstructured Optical Fiber Sensors for Sensing Surrounding Refractive Index and Surrounding Temperature

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Abstract

The key challenge for new Photonic Crystal Fiber (PCF) sensor is to achieve high sensitivity while keeping fabrication process simple. For PCF-based Refractive Index (RI) sensing at ultralow concentrations, sufficient light-molecules interaction is necessary for high sensitivity detection. This dissertation describes the key research contribution to the development of high RI sensitivity In-Line Microbubble (ILM) PCF sensor for various sensing applications. The work leads to the first report of PCF modal interferometry based sensor with ILM for RI sensing; Prior work has focused on strain or temperature sensing. A thorough search of the relevant literature also yielded only the ILM PCF biosensor being the first bioaffinity report using PCF modal-based interferometer. The dissertation also covers significant research contribution to PCF coupler structure with selective infiltration of nematic liquid crystal, and modeling, with simulation software, the micro-channel structure inside single mode fiber to find the most optimal structure.