Fiber Loop Supercontinuum Cavity Enhanced Absorption Spectroscopy

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Supercontinuum is a technique developed in recent decades to generate a stable spatial coherent broadband light source from a very narrowband pump source. In this work, a 15-meter-long Photonic Crystal Fiber (PCF) is connected to a laser source as a Supercontinuum generator. The pump source is a Q-switched solid state Nd:YVO4 laser working at 1064 nm. By tuning the pump laser to work at a power between 300mW and 1 W, a Supercontinuum is generated to cover a region from 450nm to 1600nm. With different pump laser power, the output Supercontinuum power differs, and usually a higher power can give a broader spectrum. Using this Supercontinuum source, we intend to build a fiber loop by fusion splicing a long single mode fiber to the PCF. A tapered fiber is fabricated on the loop to work as a sensor in liquid phase. It is put into liquid samples like water and organics (methanol, ethanol, isopropanol, acetone, etc.). By comparing different spectra with a spectrum without samples, we are able to tell what each sample is and finally tell the concentrations of different components in a mixed sample. A fiber taper is fabricated by heating a single mode fiber and pulling it along two ends at the same time. It is made to become narrower in the tapered region so that fiber cladding can be thinner. The evanescent wave is easier to get outside the fiber to be absorbed by whatever around it. The reaction of evanescent wave with different samples gives different spectra, so we are able to tell what kind of samples we have.