

## MID-IR LASER SPECTROSCOPY OF COF<sub>2</sub> BETWEEN 1953.5 CM<sup>-1</sup> AND 1956.0 CM<sup>-1</sup>

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This talk will describe the recent development of a user-friendly mid-IR laser spectrometer, one that does not need liquid nitrogen refills, and its use in the measurement of carbonyl fluoride (COF<sub>2</sub>). COF<sub>2</sub> is a reaction product that is formed during fluorocarbon plasma etching of oxide insulators. Its measurement can provide etching endpoint detection information for high yield semiconductor manufacturing. A IV-VI semiconductor mid-IR laser with single mode emission in the 5.2 micron spectral range was selected to probe the R-branch of the  $\nu_1$  band of COF<sub>2</sub>. Individual rovibrational lines for COF<sub>2</sub> as well as an H<sub>2</sub>O line at 1955.0 cm<sup>-1</sup> were easily resolved with a spectral resolution of better than 0.005 cm<sup>-1</sup> using second harmonic detection. Gas samples containing COF<sub>2</sub> were generated by burning Teflon (PTFE) with a propane torch and collected into a 10 cm long gas cell equipped with CaF<sub>2</sub> windows held at a pressure of 200 Torr. COF<sub>2</sub> concentration values higher than 200 ppm were measured using this setup, which had a minimum detection sensitivity of about 50 ppm. In addition to obtaining laser absorption spectra between 1953.5 cm<sup>-1</sup> and 1956.0 cm<sup>-1</sup>, concentration values for both COF<sub>2</sub> and H<sub>2</sub>O were obtained every 100 msec. Exponential fits to the data showed that both COF<sub>2</sub> and H<sub>2</sub>O molecules had lifetimes of about 12 minutes suggesting that they react with each other to form HF and CO<sub>2</sub>.