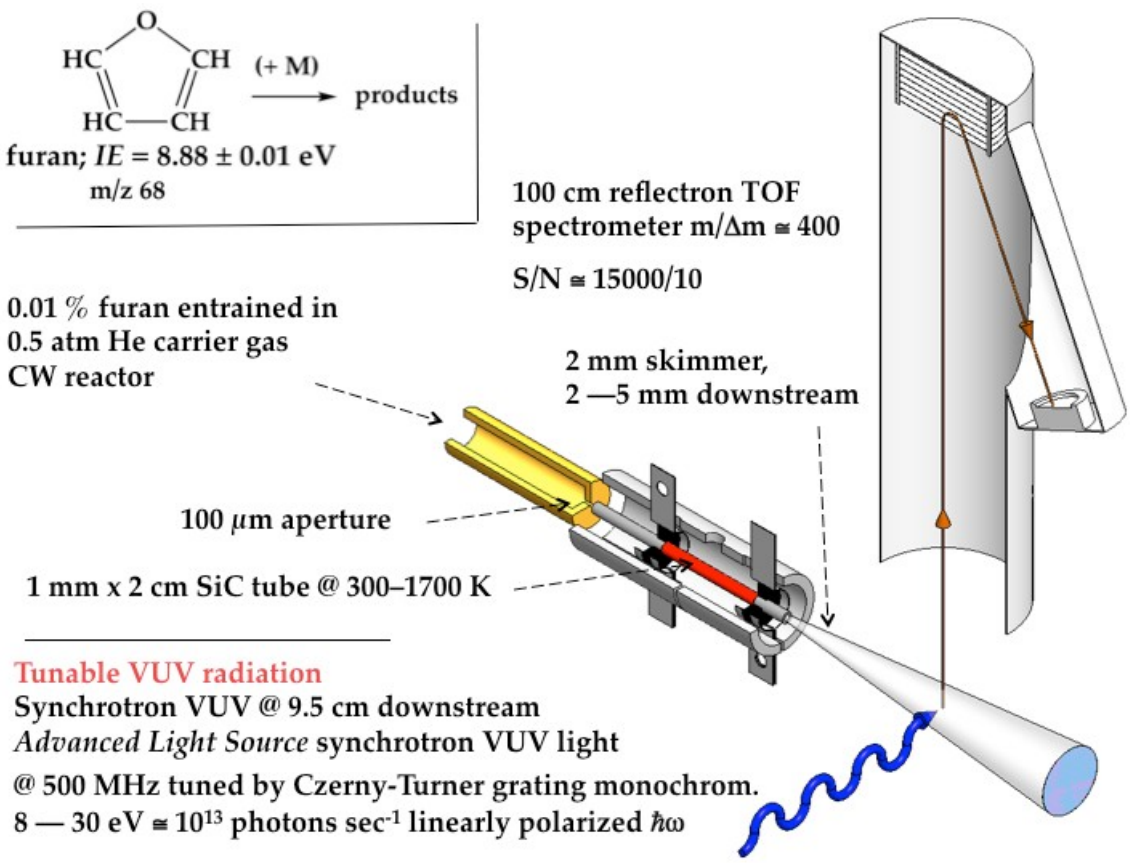
Organic Radicals in Pyrolysis of Furans and Biomass-Based Fuels

G. Barney Ellison

Dept. Chemistry and Biochemistry, University of Colorado at Boulder, 215 UCB, Boulder, CO 80309, USA

A heated SiC microtubular reactor has been used to decompose the biofuels furan, 2-methylfuran, and 2-methylfuran-d_6. The pyrolysis experiments are carried out by passing a dilute mixture of furans (roughly 0.01 — 0.1 %) entrained in a stream of a buffer gas (either He or Ar) through a heated SiC reactor that is 2-3 cm long and 1 mm in diameter. Typical pressures in the reactor are 50 – 200 Torr with the SiC tube wall temperature in the range 1200 — 1700 K. Characteristic residence times in the reactor are 50 — 200 µsec after which the gas mixture emerges as a skimmed molecular beam at a pressure of approximately10 µtorr. The reactor has been modified so that both pulsed and continuous mode can be studied, and results from both flow regimes are presented. Using various detection methods (Fourier transform infrared spectroscopy, IR, and both fixed wavelength and tunable synchrotron radiation photoionization mass spectrometry, PIMS), a number of products formed at early pyrolysis times (*ca.*100–200 µs) are identified: CH_3, CO, HCCH, CH_2CH_2, $HCCCH_2$, CH_3CCH,CH_2CO, $CH_2CHC{\equiv}CH$, and $CH_3CH_2C{\equiv}CH$. Experiments on ALS Beamline 9.0.2 have provided insight into the dynamics of pyrolysis of furan rings.