

## DESIGN AND PERFORMANCE CHARACTERISTICS OF A CONTINUOUS SLIT EXPANSION-FTIR SPECTROMETER SYSTEM

ROBERT L. SAMS, ROBIN S. MCDOWELL, THOMAS A. BLAKE and STEVEN W. SHARPE, *Pacific Northwest National Laboratory, P. O. Box 999, Mail Stop K8-88, Richland, WA 99352 (PNNL is operated for the US Department of Energy by the Battelle Memorial Institute under contract DE-AC06-76RLO 1830).*

Supersonic molecular beam sources have been used by the spectroscopy community to simplify high resolution, infrared spectral analysis for almost four decades. Originally, a continuous round orifice was utilized in conjunction with tunable lead-salt, difference frequency, f-center and a variety of other laser sources. More recently, a number of research groups have replaced these laser sources with Fourier transform infrared spectrometers (FTIRS) in favor of their extensive spectral coverage. These beam-FTIR systems have been operated in a variety of modes including asynchronous pulsing of the beam source and multiple pin-hole, CW sources. We report the design specifications and operating performance of a Bruker-120HR FTIRS coupled to a 12 cm x 50  $\mu\text{m}$  continuous slit molecular beam source.

The PNNL FTIR-jet spectrometer system incorporates a continuous expansion source pumped by a high throughput (600 Torr liter/second) system of roots blowers. Typical rotational cooling temperatures of 10 K are routinely achieved while vibrational temperatures appear to be significantly warmer (100 K). Spectral line widths associated with either He or Ar expansions are almost always smaller than the FTIRS ultimate resolution of  $0.0015\text{ cm}^{-1}$  (45 MHz). Despite a significantly lower signal-to-noise ratio when compared to a laser based system, the FTIR-jet spectrometer offers significant advantages including extensive spectral coverage from 4000 to  $400\text{ cm}^{-1}$ . To demonstrate the system's performance, a number of test cases including fluorocarbons, nitrous oxide monomer, and the weakly bonded nitrous oxide-argon dimer will be presented.