

High Temperature Mass Spectrometry at the NASA Glenn Research Center

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The NASA Glenn Research Center has been involved in high temperature mass spectrometry for many years. This includes Knudsen effusion mass spectrometry (KEMS) and molecular beam sampling mass spectrometry (MBSMS). For the KEMS work, we use magnetic sector and quadrupole instruments. These instruments are briefly described. The Knudsen cell flanges are interchangeable and both are configured for restricted collimation. A Monte Carlo simulation computer code has been developed to model the restricted collimation sampling system on both instruments. A recent project to obtain needed thermochemical data on silicate coatings for the hot stage of aero turbines is discussed. Some KEMS studies related to the geological sciences are also discussed.

The MBSMS instrument allows sampling and identification of high temperature vapors in an environment with a total pressure of 1 bar. It will be shown that some vapor species cannot be formed under Knudsen cell conditions, but will readily form under higher total pressures. The instrument is based on a free-jet expansion to form a supersonic molecular beam. The beam is directed to a mass spectrometer, so that the high temperature vapors can be directly sampled. This instrument is discussed and its operation is illustrated with several examples, including combustion atmospheres and high temperature hydroxide and oxyhydroxide formation.