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Center: Consortium for Materials Development in Space
The University of Alabama in Hunstville (UAH)

Project Name: **"Physical Vapor Transport Crystal Growth"**

Subproject Name: **"Mass Spectroscopic Facility"**

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Introduction

Both the Consortium for Materials Development in Space and the Center for Microgravity and Materials Research (CMMR) are pursuing projects that will greatly benefit from an inhouse chemical characterization of materials at high temperatures. Since CMMR personnel has experience with the mass spectroscopy of high temperature vapors, it was decided to establish a joint mass spectroscopic facility.

A mass spectrometer system was designed consisting of:

- Balzers QMG 511 Quadruple Mass Spectrometer (mass range 2-1023, cross beam ion source with electron acceleration voltage adjustable 5-120V)
- Balzers TSU 170 Turbomolecular Pump Station (170 l/sec)
- Alcatel 37-63M/E2M2G Diffusion Pumping System (for evacuation of (dirty) sample furnace space)
- Various high vacuum gauges and liquid nitrogen traps
- Teknivent Vector/One Mass Spectrometer Computer for control and data acquisition.

The acquisition of these components has been completed.

The remaining tasks for the completion of the mass spectroscopic facility consist of the design and construction of a:

- a vapor inlet system with cryogenic collimator, that minimizes the formation of molecular species that are sample-non-specific;
- a cryogenic chopper for the molecular beam, that in connection with phase-locked signal acquisition will increase the signal-to-noise ratio; and
- a multi-zone, programmable sample furnace.

These parts of the system are being designed and will partly be constructed in the UAH metal shop. Complete assembly and first test runs with the whole system can be expected in 8-9 months.

The first investigations to be conducted with the completed facility will be concerned with the high-temperature out-gassing behavior of quartz ampoules and the vapor composition in crystal growth experiments of the CMDS. These will give important insight on the prevailing transport mechanisms in these crystal growth experiments and supply a realistic basis for the numerical modeling of heat and mass transfer in these systems.