

CHAPTER III. Experiments

Experiments were performed at LANL by Thomas and Vogt [12] to provide data which can be used to validate a computational model of continuous processing of "thermal runaway" materials. The setup consists of a single-mode TE_{10n} cavity coupled to a broadband traveling wave tube (TWT) amplifier. For these experiments the nominal frequency was set at 2.93 GHz. The cavity consists of a water cooled copper WR284 waveguide with a coupling iris, a "beyond-cutoff" coupler at the inlet, and an adjustable short. The sample is fed by a stepping motor through two ports located at the top and bottom which are aligned approximately with the electric field maximum. One of the two side ports is used for the insertion of an Accufiber optical thermometer (OFT) to measure temperatures near the midpoint of the cavity and the other for video recording. The temperatures are calculated from the ratio of radiation intensities at 800 and 950 nm.

Mullite rods ranging from 1mm to 5mm in diameter were heated. This thesis compares the computational results to two cases: 2mm diameter and 4.67mm diameter mullite rods. The 2mm diameter mullite rod was heated while moving at a steady speed through the cavity. The power and frequency were adjusted appropriately to achieve steady temperatures. At this point the velocity was increased and the power and frequency again were adjusted to obtain steady temperatures. A 4.67mm diameter rod was heated while stationary, and the temperatures were controlled by the same process: adjusting the power and frequency. The input power was increased periodically to raise the temperature of the rod. The forward and reflected powers were measured along with the temperature data at one second intervals.

Visual observations of these experiments revealed the presence of a small hot area near the midpoint of the rod. It was initially assumed that this was caused by field nonuniformities along the rod length, possibly caused by the cavity penetrations described above. Further study of the thermal behavior demonstrates the dominant contribution to the hot spot.