

MICROGRAVITY SCIENCES AND PROCESSES (A2)  
Science Results from Ground Based Research (4)

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## STATISTICAL RATE THEORY EXAMINATION OF ETHANOL EVAPORATION

**Abstract**

A series of low-temperature ( $246 \text{ K} < T_I^L < 267 \text{ K}$ ) steady-state ethanol evaporation experiments have been conducted to determine the saturation-vapor pressure of metastable ethanol. The measured interfacial conditions have been used with statistical rate theory (SRT) to develop an expression for the saturation-vapor pressure as a function of temperature,  $f_{srt}^{eth}$ . This expression is shown to be thermodynamically consistent because it gives predictions of both the evaporative-latent heat and the liquid-constant-pressure-specific heat that are in agreement with independent measurements of these properties. In each experiment, the interfacial-vapor temperature was measured to be greater than the interfacial-liquid temperature:  $\equiv \Delta T_I^{LV}$ . When  $f_{srt}^{eth}$  is used in SRT to predict  $\Delta T_I^{LV}$ , the results are shown to be consistent with the measurements. Other expressions for the saturation-vapor pressure that are in the literature are examined and found to be thermodynamically inconsistent, and do not lead to valid predictions of  $\Delta T_I^{LV}$ .