

Circumstellar Silicates Do Nucleate: New Vapor Pressure Data for SiO

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February 3, 2006

Abstract

We have measured the vapor pressure of solid SiO as a function of temperature over the range from 1200K up to 1950K in vacuo using a modified Thermo-Cahn Thermogravimetric system. Although the vapor pressure measured near 2000K is close to that predicted from the work of Schick[1] under reducing conditions, the vapor pressures measured at lower temperatures diverge significantly from such predictions and are several orders of magnitude lower than predicted at 1200K. This new vapor pressure data has been inserted into a simple model for the gas expanding from a late stage star. Using the new vapor pressure curve makes a significant difference in the temperature and stellar radius at which SiO gas becomes supersaturated, although SiO still becomes supersaturated at temperatures that are too low to be consistent with observations. We have therefore explored including the effects of vibrational disequilibrium² of SiO in the expanding shell on the conditions under which nucleation occurs. These calculations are much more interesting in that supersaturation now occurs at much higher temperatures. We note however, that both vibrational disequilibrium and the new vapor pressure are required to induce SiO supersaturation in stellar outflows at temperatures above 1000K.

[1] H. L. Schick, Chem. Rev. 60 (1960) 331.

[2] J. A. Nuth, B. D. Donn, Astrophys. J., 247 (1981) 925.

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