Kinetics of Thermochemical Reactions Important in the Venus Atmospheric Sulfur Cycle

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Abstract. This final report summarizes the significant accomplishments of research at Washington University in St. Louis for NASA Grant NAGW-2867 "Kinetics of Thermochemical Reactions Important in the Venus Atmospheric Sulfur Cycle", Professor Bruce Fegley, Jr., PI.

Summary. The purpose of this project was to experimentally measure the rates of several thermochemical gas-solid reactions between sulfur gases in the Venus atmosphere and reactive minerals on the hot Venus surface. Despite the great importance of these reactions for the maintenance of significant amounts of sulfur gases (and thus for the maintenance of the global cloud cover) in the atmosphere of Venus, essentially no kinetic data are currently available for them.

Results. The results of this project have all been published in refereed publications. These publications are listed below.

1. M.K. Shepard, R.E. Arvidson, R.A. Brackett, and B. Fegley, Jr. (1994) A Ferroelectric Model for the Low Emissivity Highlands on Venus. *Geophys. Res. Lett.* **21**, 469-472.

2. J.S. Kargel, R.L. Kirk, B. Fegley, Jr., and A.H. Treiman (1994) Carbonate-Sulfate Volcanism on Venus? *Icarus* **112**, 219-252.

3. R.E. Arvidson, M.K. Shepard, R.A. Brackett, N.R. Izenberg, B. Fegley, Jr., and J.J. Plaut. (1994) Microwave Signatures and Surface Properties of Ovda Regio and Surroundings, Venus. *Icarus* **112**, 171-186.

4. B. Fegley, Jr., K. Lodders, A.H. Treiman, and G. Klingelhöfer (1995) The Rate of Pyrite Decomposition on the Surface of Venus. *Icarus* **115**, 159-180.

5. R.A. Brackett, B. Fegley, Jr. and R.E. Arvidson (1995) Volatile Transport on Venus and Implications for Surface Geochemistry and Geology. *J. Geophys. Res-Planets* **100**, 1553-1563.

6. K.H. Baines, R.W. Carlson, D. Crisp, J.T. Schofield, B. Bézard, C. DeBergh, P. Drossart, W.A. Delamere, B. Fegley, Jr., W.H. Smith, S.J. Limaye, C.T. Russell, G. Schubert, S. Calcutt, and F.W. Taylor (1995) VESAT: The Venus Environmental Satellite Discovery Mission. *Acta Astronautica* **35**, 417-425.

7. B. Fegley, Jr. (1995) Properties and Composition of the Terrestrial Oceans and of the Atmospheres of the Earth and Other Planets, in *Global Earth Physics A Handbook of Physical Constants*, AGU Reference Shelf 1, ed. T. Ahrens, AGU, Washington, D.C., pp. 320-345.

8. B. Fegley, Jr., M.Yu. Zolotov, and K. Lodders (1997) The Oxidation State of the Lower Atmosphere and Surface of Venus. *Icarus*, **125**, 416-439.

9. B. Fegley, Jr. (1997) Why Pyrite is Unstable on the Surface of Venus. *Icarus* **128**, 474-479.

10. B. Fegley, Jr., G. Klingelhöfer, K. Lodders, and T. Widemann (1997) Geochemistry of Surface-Atmosphere Interactions on Venus, in *Venus 2*, ed. S.W. Boucher, D.M. Hunten & R. Phillips, Univ. of Arizona Press, in press.

11. Y. Hong and B. Fegley, Jr. (1997) The Sulfur Vapor Pressure over Pyrite on the Surface of Venus. *Planet. Space Sci.*, in press.

12. K. Lodders, G. Klingelhöfer, and D.T. Kremser (1997) Chloritoid Inclusions in Pyrite from Navajun, Spain. *Canadian Mineralogist*, in press.

13. Y. Hong and B. Fegley, Jr. (1997) Formation of Carbonyl Sulfide (OCS) from Carbon Monoxide and Sulfur Vapor and Applications to Venus. *Icarus*, in press.

14. Y. Hong and B. Fegley, Jr. (1997) Kinetics and Mechanism of Pyrite Thermal Decomposition. *Ber. Bunsenges. Phys. Chem.*, in press.