VIII. CONCLUSIONS

The purpose of this study was to determine the feasibility of using a liquid germanium film, plated on a graphite or molybdenum substrate, as a target in the molecular beam machine. This purpose was accomplished. It was concluded that neither graphite nor molybdenum is a suitable substrate material and, therefore, the proposed targets are infeasible.

IX. RECOMMENDATIONS FOR FUTURE CONSIDERATIONS

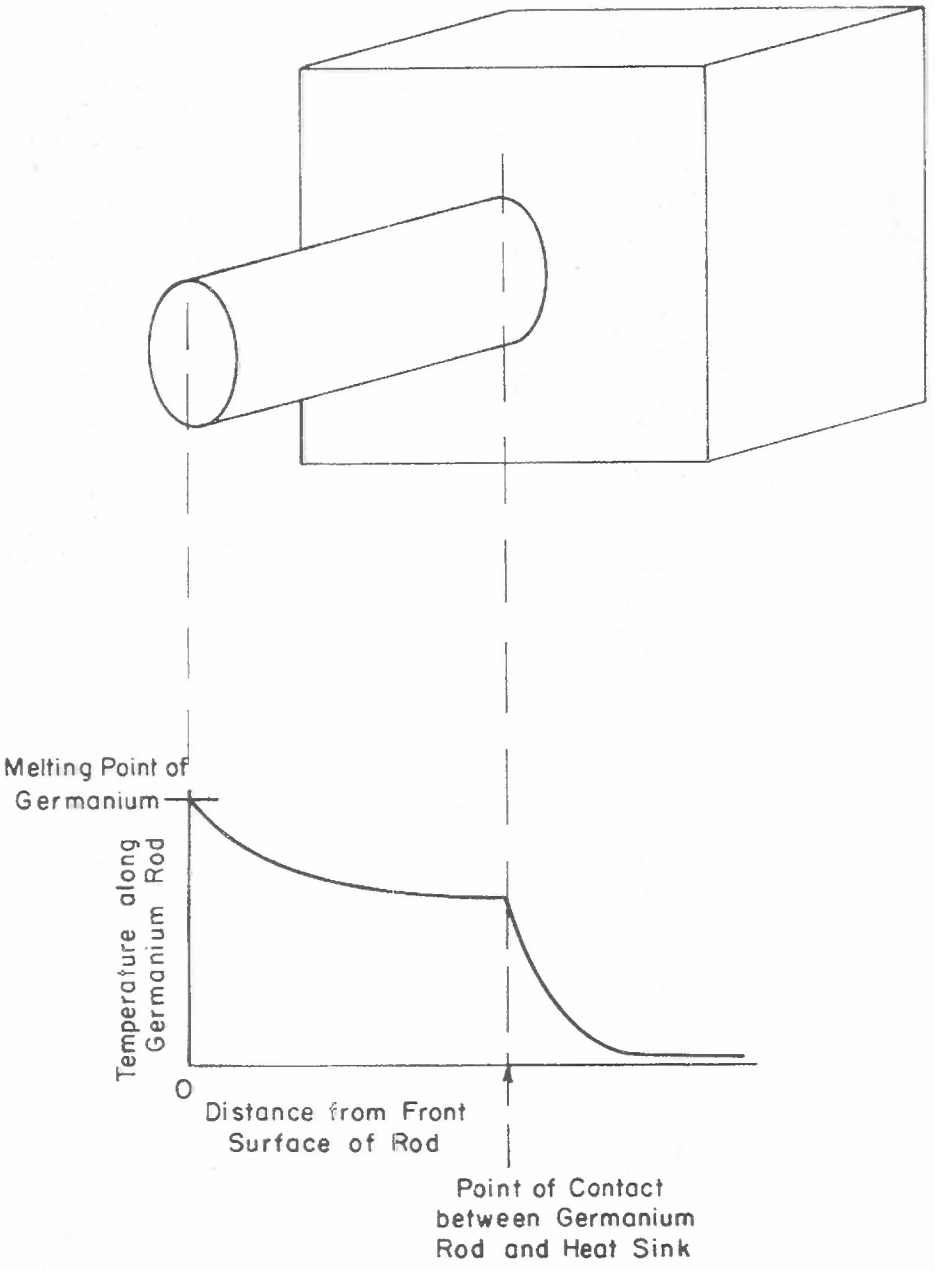
Even though the first concerted attempt to develop a target to study a gas-liquid reaction in the molecular beam machine was not successful, there remain many other possible approaches.

The most obvious approach would be to test other materials for use as substrates. For example, various ceramics might be suitable for this application.

Instead of a solid substrate, it might be desirable to employ a porous substrate. The voids in such a substrate could be filled with germanium. During a reaction run the target would be heated. As the germanium left the surface of the substrate, liquid germanium held within the pores could creep to the surface to maintain the film.

It might be possible to use a germanium rod as a target. See Fig. 20. The rod could be heated by electron bombardment, by a laser beam, by an electric current, or by induction. If the back of the rod were connected to a heat sink a thermal gradient would be set up as depicted by the graph in Fig. 20. If the shape of the rod were chosen correctly and the heating controlled properly, it should be possible to maintain a thin liquid film on the front surface of the germanium rod.

Another possibility is that the molecular beam machine could be altered or that a new molecular beam machine could be built to accomodate horizontal targets. This would necessitate raising the molecular beam from the horizontal, but might be the simplist alternative.



XBL 702-311

Fig. 20. Heat sink target.

ACKNOWLEDGEMENTS

This work has been supported by the United States Atomic Energy Commission through the Lawrence Radiation Laboratory.

I wish to thank Professor Donald R. Olander of the Department of Nuclear Engineering, University of California, Berkeley, for his guidance and patience.

I am indebted to Mr. Harry Brown for the construction and loan of the electron beam heater and to Miss Jane Ball for her accurate help in preparing the rough andfinal drafts of this thesis. I would like to give special thanks to Miss Phyllis Egan.

REFERENCES

1. Robert A. Krakowski, "Dissociation of Hydrogen on Tantalum Using Modulated Molecular Beam Technique," Ph.D. Thesis, March 1967, Nuclear Engineering Department, University of California, Berkeley.

2. "The Electron Beam and Evaporation," Airco Temescal Division of Air Reduction Co., 2850 Seventh Str. Berkeley, Ca. 94710.

3. Siegfried Schiller and Bernd Wenzel, "Viewing High Vacuum Processes," Research and Development, April, 1969.

4. Clarence L. Smith, "Conditions and Considerations in High Rate Thick Film Vacuum Deposition Processes," Systems Manufacturing Division, Poughkeepsie, New York.

5. A. W. Searcy, "The Vapor Pressure of Germanium," J. Amer. Chem. Soc., 74, No. 19, p. 4789-4791, 1952.

6. R. D. Freeman and A. W. Searcy, "The Vapor Pressure of Germanium and the Molecular Weight of Germanium Vapor," J. Chem. Phys. 23, p.88, 1955.

7. V. I. Davydov, Germanium, Gordon and Breach, New York, 1966.

8. J. W. Taylor, "Wetting by Liquids Metals," Progress in Nuclear Energy, Series V, Metallurgy and Fuel, Eds. H. M. Finniston and J. Howe, Pergamon Press, 1959.

9. K. F. J. Heinrich, Editor, Quantitative Electron Probe Microanalysis, National Bureau of Standards, Special Publication 298, October 1968.

10. H. J. Kostkowski and R. D. Lee, "Theory and Methods of Optical Pyrometry," National Bureau of Standards Monograph 41, March 1, 1962.

11. B. T. Price, C. C. Horton, K. T. Spinney, Radiation Shielding, p. 218-219, Pergamon Press, New York, 1957.

12. R. J. Madix and A. A. Susu, "Reactive Scattering of Atomic Oxygen from Clean Elemental Semiconductor Surface," Department of Chemical Engineering, Stanford University, Stanford, Ca. 94305, June 21, 1969.