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DIFFUSION OF MOLYBDENUM THROUGH H-451 GRAPHITE

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DISCLAIMER

Diffusion rates of molybdenum through graphite were determined in the temperature range of 2250°C to 3300°C. This work was conducted to characterize the behavior of fission products under an unrestricted core heat-up accident condition in a HTGR (High Temperature Gas Cooled Reactor). Molybdenum is present in the HTGR as one of the major fission products.

A thin layer of Mo_2C was loaded into a flat bottomed cavity (diameter; 50.8 mm) of an H-451 graphite (Great Lakes Carbon Corp.) cylinder (82.6 mm x 152.4 mm) which forms the susceptor of a 30 Kw induction furnace (Tocco Corp.). Temperature is measured with an automatic optical pyrometer. The cylindrical portion below the Mo_2C melt was sliced into wafers which were then ashed in a low temperature (<200°C) plasma asher and assayed for molybdenum.

A concentration profile is generally characterized by a steep gradient with shallow penetration (~6 mm after 33 minutes at 3300°C) followed by a smooth curve with a smaller gradient and a long tail with a even smaller gradient. Assuming that only one diffusion mechanism is predominating and that radial diffusion is not negligible, the heat conduction computer code, TAC-2D, was used to solve the time dependent two-dimensional analog. The resulting diffusiion coefficients are self-consistent, but the data fitting is not always satisfactory.(1)

This paper describes an alternative method that assumes at least two different diffusion mechanisms (possibly three) are involved.

In their study on diffusion of uranium through graphite, Lock et al(2) also observed large gradients at the interface with shallow penetrations (less than 0.04 cm after 2 hours at 2400°C) and small gradients at deeper penetra-

Acnowledgements

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References

1. BNL-NUREG-51217, Advanced Reactor Safety Research Division, Quarterly Progress Report January 1 - March 31, 1980, p. 76, Brookhaven National Laboratory, 1980.

2. L. D. Loch, J. R. Gambino, and W. H. Duckwort, ''Diffusion of Uranium through Graphite,'' A.I.Ch.E. Journal, Vol. 2, 2, 196, 1956.

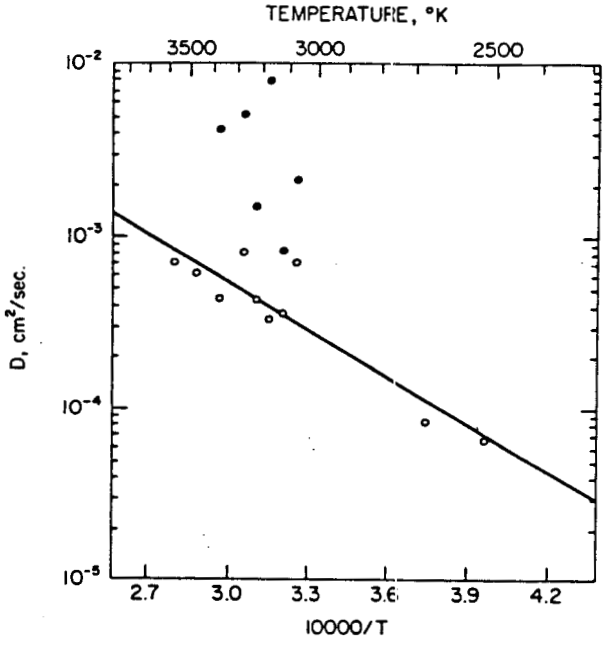

Figure 2. Arrhenius plots of diffusion coefficients.