

DIFFUSION OF MOLYBDENUM THROUGH H-451 GRAPHITE

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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 diffusion 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-

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References

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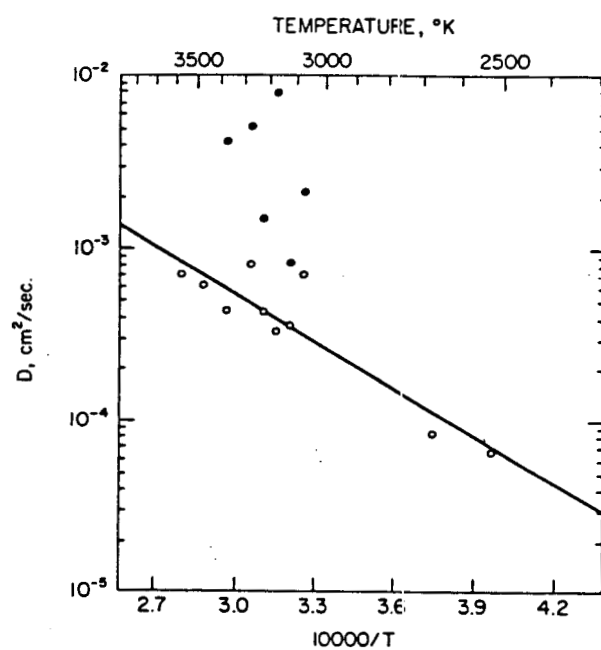


Figure 2. Arrhenius plots of diffusion coefficients.