

DIFFUSION IN LIQUID STATE AND SOLIDIFICATION OF BINARY SYSTEM  
M-7

T. Dan  
National Research Institute for Metals  
Japan

## Abstract

Diffusion is one of the most fundamental physical phenomena. It relates to the manufacturing processes of almost all materials. Therefore, the precise knowledge of diffusivities of relevant materials is necessary for the optimization of these processes. On the other hand, such knowledge is indispensable to understanding the diffusion mechanism and structure of liquid metal in the field of physical metallurgy.

Many diffusion experiments on solid metal have been undertaken and a lot of data have been accumulated. But on liquid metals there are few measurements because of experimental difficulties, such as thermal convection, induced by very slight temperature gradients in the specimen.

Under microgravity conditions, the movement of liquid metal due to density differences and thermal convection must be suppressed markedly. Therefore, the transportation process will be controlled only by the diffusion of constituent atoms. These conditions offer the optimum environments for the diffusion experiment.

We briefly describe the experimentals below. Diffusion couples are prepared by attaching end to end two rods of different pure metals using hot press equipment. These couples are inserted into a graphite crucible and then doubly enclosed by two silica ampoules, respectively

(Figure 1). The specimen is inserted into a tantalum cartridge, which is welded in a vacuum using an electron-beam apparatus. These cartridges are charged in the continuous heating furnace in space and held at a given temperature for a predetermined time and then solidified.

The concentration distribution of elements in these specimens will be measured along the rod axis by means of an electron probe microanalyzer. The counterdiffusivity of the liquid metal binary system is determined on the basis of the compensated concentration distribution profile for thermal contraction.

### Expected Results

The results obtained by this experiment will contribute to the elucidation of the diffusion mechanism and the structure of liquid metal. Moreover, these results could be applied to both conventional and new manufacturing processes of materials not only in space but also on the ground in the near future.

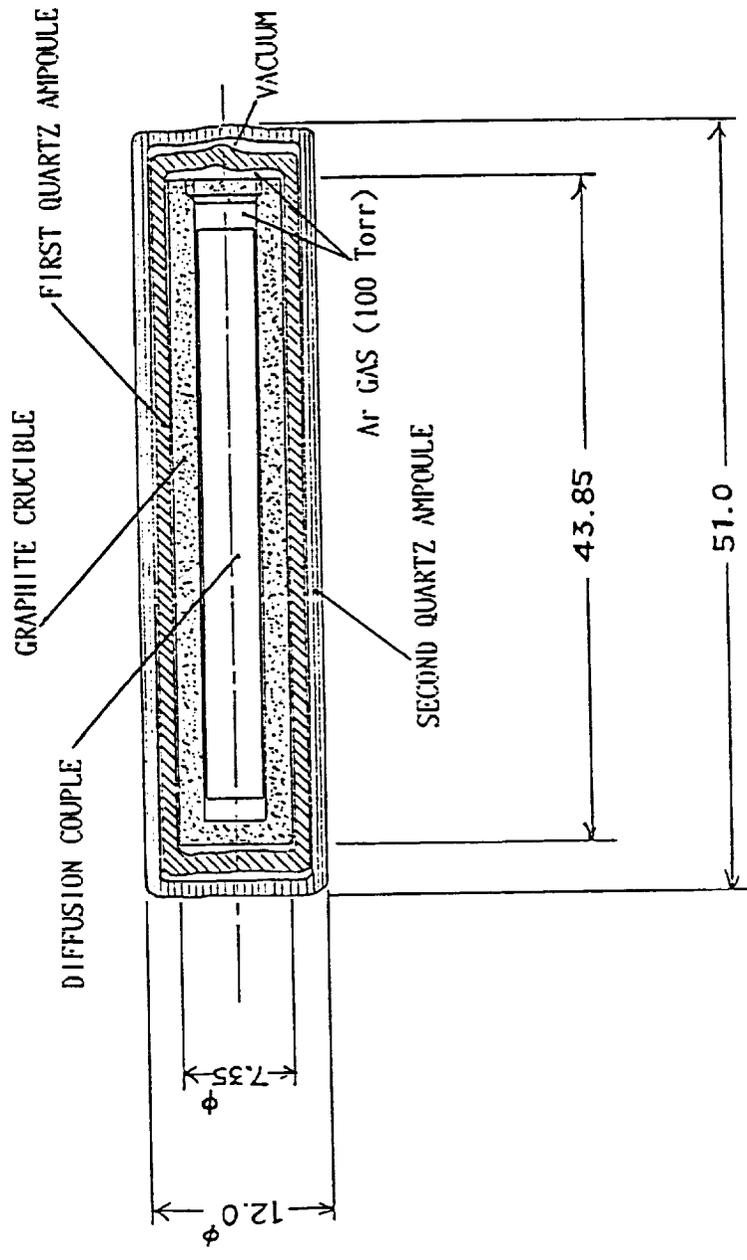


Figure 1. Configuration of M-7 specimen.

