FATIGUE BEHAVIOR OF COPPER AND SELECTED COPPER ALLOYS FOR HIGH HEAT FLUX APPLICATIONS - K. D. Leedy, J. F. Stubbins (University of Illinois), B. N. Singh (RISØ National Laboratory), and F. A. Garner (Pacific Northwest National Laboratory)

To be published in J. Nuclear Materials, 1996 proceedings of ICFRM-7

Extended Abstract

The room temperature fatigue behavior of standard and subsize specimens was examined for five copper alloys: OFHC Cu, two CuNiBe alloys, a CuCrZr alloy, and a Cu-Al_2O_3 alloy. Fatigue tests were run in strain control to failure. In addition to establishing failure lives, the stress amplitudes were monitored as a function of numbers of accrued cycles. The results indicate that the alloys with high initial yield strengths provide the best fatigue response over the range of failure lives examined in the present study: $N_f = 10^3$ to 10^6. In fact, the fatigue performance of the best alloys is dominated by the elastic portion of the strain range, as would be expected from the correlation of performance with yield properties. The alumina strengthened alloy and the two CuNiBe alloys show the best overall performance of the group examined here. It was found that the fatigue response is closely related to the uniformity of the material microstructure and particularly the distribution of the finely dispersed strengthening phases. The pre- and post- fatigue microstructures were examined to identify the types and distribution of secondary phases, and their role in fatigue response.

[1] Operated for the US Department of Energy by Battellle memorial Institute under Contract DE-AC06-76RLO 1830.