Quarterly Management Report

WBS Element	Project Title	Contract Number	Contract Start	Contract End
ORNL-2(I)	Mo-Si Alloy Development	FEAA028	10/01/03	09/30/04

Performer Name and Address	Principal Investigator(s)
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BUDGET AND COST REPORT

Prior Year Funds [$K]	13
Total Current Year Commitment $K]	142
Projected Current Year Costs [$K]	155

	O	N	D	J	F	M	A	M	J	J	A	S
Planned Costs	12	25	38	51	64	77	90	103	116	129	142	155
Actual Costs	16	26	35	46	52	64						
Variance	(4)	(1)	3	5	12	13	90	103	116	129	142	155

MILESTONE REPORT

Milestone Designation	Milestone Description	Due Date	Revised Due Date	Completion Date
ORNL-2(I)-1	Examine the influence of Si3N4 additions on the oxidation resistance of Mo-Si-B alloys	03/31/03		04/28/04
ORNL-2(I)-2	Examine oxidation-resistant coatings such as MoSi2 on Mo-Si-B alloys	09/30/03		04/28/04
ORNL-2(I)-3	Examine effects of Al and AlN on the oxidation resistance of Mo-Si-B alloys	03/31/04	08/30/04	
ORNL-2(I)-4	Fabricate light-weight Mo-Nb-Si-B alloys consisting of alpha-Mo, (Mo,Nb)5Si3, and (Mo,Nb)5SiB2 and assess their strength and oxidation resistance	09/30/04		
ORNL-2(I)-5	Ductilize molybdenum by incorporating suitable spinel or oxide particles and determine the ductile-to-brittle transition temperature	03/31/05		
ORNL-2(I)-6	Fabricate molybdenum with the aim to optimize oxidation resistance and ductility at the same time	09/30/05		

TECHNICAL HIGHLIGHTS

In the previous quarterly report, specimens of nominally pure Mo and Mo specimens containing 5, 10, and 15 vol. % $MgAl_2O_4$ spinel particles were hot-pressed from powders. A combination of metallography and x-ray powder diffraction showed that none of these specimens contained embrittling MoO_2 particles (which were encountered in earlier specimens). Tensile specimens were machined and their gage lengths were ground to a 600 grit SiC finish. Room temperature tensile tests were carried out at two different initial strain rates, 0.01 and 0.0001/s. The ductility values (%) as a function of spinel volume fraction and strain rate are :

v/o	0.001/s	0.01/s
0	11.1	3.8
0	50.3	
0	39.0	
5	19.6	4.2
5	19.3	8.7
10	9.9	3.2
10	9.8	8.3
15	3.9	3.2
15	3.8	2.2

The scatter in the ductility values for a given value of the spinel volume fraction and the strain rate can be high. The pure Mo, in particular, shows a very large scatter. The reasons for the scatter are not well known. The discs, from which the specimens were cut, were hot-pressed in graphite dies at 1800C. It is possible that there is a carbon gradient along the axes of the discs. Differences in the carbon concentrations and therefore the C/O ratio of different specimens cut from the same disc may result in differences in ductility. The present data show too much scatter to be able to verify the spinel ductilization mechanism. Also, there are issues such as the fraction of intergranular vs. transgranular fracture, and the potentially embrittling effect of large spinel particles (e.g., 60 micron) found on fracture surfaces. Additional work is in progress to sort out these issues.

ISSUES

Report Prepared By	Date
Joachim H. Schneibel	06/08/04