Quarterly Management Report

WBS Element	Project Title	Contract Number	Contract Start	Contract End
ORNL-2D	Multi-Phase High-Temperature Alloys			

Performer Name and Address	Principal Investigator(s)
ORNL	M.P. Brady, Z.P. Lu, and C.T. Liu

BUDGET AND COST REPORT

Prior Year Funds [$K]	0
Total Current Year Commitment $K]	112
Projected Current Year Costs [$K]	112

	O	N	D	J	F	M	A	M	J	J	A	S
Planned Costs	5	15	25	35	45	60	70	80	85	95	105	112
Actual Costs	5	20	32	39	45	53						
Variance	0	(5)	(7)	(4)	0	7	70	80	85	95	105	112

MILESTONE REPORT

Milestone Designation	Milestone Description	Due Date	Revised Due Date	Completion Date
2D1	1. Establish baseline high-temperature strength and phase stability in the developmental C14 and B2 precipitated Fe-20Cr-(10-20)Ni atomic percent base	06/30/05		

TECHNICAL HIGHLIGHTS

Efforts are underway for the development of multi-phase alloys for improved high-temperature strength. Work is currently focused on advanced austenitic alloys based on Al-modified Fe-(10-20)Cr-(15-25)Ni (at.%), strengthened by combinations of: (1) solid solutes, (2) carbide precipitates (MC), and (3) Laves phase precipitates. This effort is partially linked with that of 4A, “Controlled Oxidation for Functional and Protective Surfaces”.

Creep rupture studies at 750°C and 100 MPa in air were conducted for the initial series of Al-modified Fe-20Cr base alloys strengthened by AB2 Laves, MC carbide, and AB phases. Lifetimes were on the order of only 50 h, comparable to unoptimized austenitic alloys. Microstructural analysis revealed that the alloys were initially duplex BCC/FCC, and that the BCC regions converted to sigma phase during the course of the creep exposure. Modification of alloy additions was then made to ensure a single-phase FCC structure. The first of these alloys exhibited the desired single-phase austenitic structure, but also formed coarse Laves-MC structures at the grain boundaries, rather than a fine uniform distribution such as was observed in the first set of alloys. Creep rupture lifetimes were on the order of 120 h, a step in the correct direction but still far short of the desired lifetime of several thousand hours under these conditions. Based on these results, further adjustment of minor alloying additions and heat treatment schedule will be pursued in the next quarter to obtain a fine distribution of AB2 and MC + AB2 in an Al-modified austenitic alloy. This work will include increased emphasis on phase equilibria and microstructure evolution understanding to guide the alloy development efforts.

ISSUES

none

Report Prepared By	Date
MP Brady	05/26/05