Quarterly Management Report

WBS Element	Project Title	Contract Number	Contract Start	Contract End
ORNL-4A	Controlled Oxidation for Functional and Protective Surfaces			

Performer Name and Address	Principal Investigator(s)
ORNL	M.P. Brady, P.F. Tortorelli, and E.A. Payzant

BUDGET AND COST REPORT

Prior Year Funds [$K]	0
Total Current Year Commitment $K]	200
Projected Current Year Costs [$K]	200

	O	N	D	J	F	M	A	M	J	J	A	S
Planned Costs	15	32	49	70	90	120	150	160	170	180	190	200
Actual Costs	15	30	45	62	93	138						
Variance	0	2	4	8	(3)	(18)	150	160	170	180	190	200

MILESTONE REPORT

Milestone Designation	Milestone Description	Due Date	Revised Due Date	Completion Date
4A 1	1. Complete initial studies of the oxidation behavior of the first series of developmental intermetallic strengthened steels and document the results in a	08/30/05		
4A 2	Complete a series of exploratory experiments to establish the range of functional ceramic surface structures that can be synthesized via oxidation	09/30/05		

TECHNICAL HIGHLIGHTS

This effort is partially linked with that of 2D, “Multi-Phase High Temperature Alloys”.

Auger and XPS surface analysis was completed for a set of Al-modified AB2, AB, and MC strengthened Fe-(10-20)Cr-(15-25)Ni (at.%) base alloys oxidized at 800°C in air and 800°C in air + water vapor. The XPS data indicated that the surface chemistry was nearly identical in air and air + water vapor, consistent with the excellent oxidation resistance observed. Auger analysis through the scale was consistent with a M2O3 type scale, where M was Al-rich but also contained small amounts of Cr and Fe. Microstructural analysis of these alloys indicated that they were duplex BCC/FCC, rather than the desired single-phase austenitic structure, which resulted in poor creep rupture life behavior (see 2D report). Al is a significant BCC stabilizer, however it imparted significant gains in oxidation resistance at levels of only 5 at.% (2.4 wt.%). Modifications of alloy chemistry to shift the alloy to single-phase FCC to improve creep behavior, while maintaining the Al level needed for improved oxidation resistance are underway. This work will emphasize phase equilibria of austenite, ferrite, Laves phase, NiAl, and MC carbides in the presence of minor additions of Al.

Work continued this quarter on synthesis of novel ternary carbide and nitride phases of interest for functional applications such as catalysis, utilizing gas reactions of intermetallic precursors. First attempts at carburizing intermetallic CoMo powders and CoMo coated alumina powders were made. The intermetallic powder, in particular, exhibited a strong tendency to sinter under the baseline conditions. Phase analysis of the powders is underway. Continued work on the baseline model Cr3Pt alloys yielded significant insight into the formation of Cr3PtN antiperovskite phase on gas nitridation. In particular, evidence was obtained for an intermediate L12 precursor structure stabilized by impurities that precedes the transition from the A15 Cr3Pt to the anti-perovskite structure, which is essentially an L12 structure with interstitial N. This finding suggests the use of L12 precursors to form anti-perovskite carbide and nitride phases. Several L12 precursor phases, which represent a range of metallurgical and thermodynamic features were selected for study and will be cast in the upcoming quarter.

ISSUES

None

Report Prepared By	Date
MP Brady	05/26/05