Quarterly Management Report

WBS Element	Project Title	Contract Number	Contract Start	Contract End
ORNL-1(B)	Corrosion Resistant Coatings	FEAA028	10/01/99	09/30/31

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

Prior Year Funds [$K]	146
Total Current Year Commitment $K]	225
Projected Current Year Costs [$K]	371

	O	N	D	J	F	M	A	M	J	J	A	S
Planned Costs	30	60	90	120	150	180	210	240	270	300	330	371
Actual Costs	17	47	74	89	129	161						
Variance	13	13	16	31	21	19	210	240	270	300	330	371

MILESTONE REPORT

Milestone Designation	Milestone Description	Due Date	Revised Due Date	Completion Date
ORNL-1(B)-1	Develop slurry process for Al based coatings for ferritic martensitic based alloys.	09/30/07		
ORNL-1(B)-2	Complete the deposition, exposure and evaluation of the slurry-based coatings on ferritic steels.	09/30/08		
ORNL-1(B)-3	Develop a slurry-based process and begin deposition of coatings for Ni-based super alloys.	09/30/09		

TECHNICAL HIGHLIGHTS

Review: This goal of this project is to improve material performance by combining intelligent materials design with colloid science and coating technology in order to develop cost-effective materials and processes engineered for optimum performance and maximum service life. Previously, this work focused on providing protection systems for ceramic based materials. Currently, lower cost methods and novel approaches of applying coatings to metals are being explored to meet more near term goals and needs of power plants. Thus, the development of novel coatings utilizing low-cost aqueous processing methods such as dip coating is being pursued. Colloidal processing of metallic particles in aqueous suspension offers an economic route for forming uniform, metallic coatings on complex-shaped components via a simple process. This project will focus on the use slurry coating for the application of coatings onto ferritic martensitic alloys, austenitic alloys, and potentially Ni-based super alloys.

Results: The colloid and rheological studies of the Al powder in aqueous solution continued. The zeta potential of the as-received Al powder in aqueous environments was characterized. Polyacrylic acid was selected as the dispersant for initial rheology studies. Apparent viscosity as a function of Al solids loadings at fixed dispersant and rheology modifier concentration was measured. Al solids were varied from 1, 3, 5, 10 and 20 volume %. Newtonian behavior was seen at 1 vol% Al concentration while at 20 vol% Al concentration a gelled or cementatious behavior was seen. In general, the viscosity increased with increasing solids concentration, and a shear thinning behavior was seen above 1 vol % and below 20 vol% Al concentrations. Samples of T91 (9%Cr, 1%Mo) that were acquired from B. Pint (ORNL) and Prof. Y. Zhang (Tennessee Tech) were coated with 5 vol % Al slurries, dried, and subsequently heat treated to either 750C or 1050C for 2 hours in an argon environment. The resulting coupons were sectioned and examined using scanning electron microscopy (SEM) or (EDPM). The coupons heat treated to 750C produced nonuniformly infiltrated Al diffusion or coating zones across the surface of the T91 alloy. However, the 1050C treated coupons showed a uniform diffusion zone across the alloy surface. The average Al concentration at the outermost surface was approximately 8 atomic % Al. The Al concentration decreased up to the penetration depth of approximately 100-120 microns. Samples were coated and heat treated at the 1050C condition to be submitted to B. Pint for environmental exposure and evaluation.

ISSUES

The Rheometrics controlled stress rheometer and Malvern Zetasizer which are utilized to characterize the viscosity and zetapotential of all materials in this project were serviced beginning in the first and continuing through the second quarter of FY07. The rheometer was returned to operational status during the second quarter, however, the Zetasizer is still out of service, and it is unknown when its repairs will be complete. Alternative equipment was utilized to maintain project continuity, however, progress was hampered immensely.

Report Prepared By	**Date**
B.L. Armstrong	04/26/07