Quarterly Management Report

WBS Element	Project Title	Contract Number	Contract Start	Contract End
	Defect Content in ODS Alloys	4000028312	11/15/03	12/31/05

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

Prior Year Funds [$K]	8
Total Current Year Commitment $K]	92
Projected Current Year Costs [$K]	

	O	N	D	J	F	M	A	M	J	J	A	S
Planned Costs	27	37	47	58	68	78	89	99	99	99	99	99
Actual Costs	8	13	20									
Variance	20	24	28	58	68	78	89	99	99	99	99	99

MILESTONE REPORT

Milestone Designation	Milestone Description	Due Date	Revised Due Date	Completion Date
D1.1	critical strain matrix work completed / reported	01/31/04		01/31/04
D1.2	Special PM2000 - alumina extrusions acquired for tests	02/28/04	03/31/04	03/31/04
D2.1	Initial tube torsion tests completed with ornl	04/30/04	08/31/04	07/31/04
D1.3	ODS-free / PM2000 rexn.overlap experiments reported	05/31/04		05/31/04
D1.4	PM2000 - alumina recrystallization report completed	07/31/04	10/31/04	10/31/04
D1.5	Influence of ODS-free can alloy on PM2000 reported	09/30/04	10/31/04	10/31/04
D3.1	Interim report on recrystallization behavior in warm flow formed tube available	11/30/04	01/31/05	
D1.6	Recrystallization behavior of a low yttria - PM2000 composite alloy reported	01/31/05		06/30/04
D2.2	Initial report completed on recrystallization behavior in torsion tested tube	03/31/05		

TECHNICAL HIGHLIGHTS

i) Steering of recrystallised grain structures in PM2000 tube

As previously reported, PM2000 tube that has been torsion tested and deformed through 120º over a 50mm gauge length has been recrystallised and a study of the grain structures arising performed.
The grain structure of the tube clearly illustrated that the prior torsional plastic deformation has had a significant effect on subsequent recrystallisation behaviour. Although the coarse grains still appeared to be aligned parallel with the tube's axis, albeit with a grain aspect ratio much reduced compared to conventionally, axially deformed and recrystallised tube, grain boundary serrations were apparent along the 'axial' boundaries and these aligned perfectly with the notional helix produced by the torsional deformation. SEM studies of the serrations showed that their orientation followed the helical distribution of oxide particles within the PM2000 and that they have aspect ratios of up to 10:1 parallel to the twist direction. Images manipulated to reveal only stringers of particles clearly showed that these were arranged in helical distributions in most cases; and it seems reasonable to assume that it is the redistribution of these particles within the alloy during twisting that steers the subsequent development of the helical orientation within the recrystallising grain structure.

ii) Torsional grain structures in PM2000 tube

A sample has been cut from a second tube (1600 twist over 25mm gauge length) that was deformed in the torsion trials performed at ORNL. The sample was recrystallised using the same conditions as the first tube (1380ºC/1 hour) and revealed a grain structure similar to that of the earlier tube except that the coarse grains in the homogeneously torsionally deformed area showed a much more distinct alignment with the macroscopic direction of torsion. Grain aspect ratios were still low, but clear, straight grain boundaries were seen to lie parallel to the direction of helical twist. Grain boundaries parallel to the tube axis had a strongly serrated appearance, with the 'teeth' of the serrations orientated parallel to the twist helix as seen in the previous tube.
The total level of torsional strain applied to the second tube was higher than that in the first tube and it appears that this may have caused a more helical grain structure to develop. However, a large matrix of conditions, as well as degree of twist, has yet to be investigated.

iii) Modelling the twisting and collapse of PM2000 tube

Possible routes to modelling the plastic deformation of PM2000 tubes during torsion have been discussed with members of the Applied Mathematics Dept. The aim is to gain information that can be used to advise further tube torsion trials.
Initial modelling is underway and is focussed on modelling the tubes that have already been deformed at ORNL in order to test the validity of the models. Once the model proves successful, the intention is to apply it to a matrix of experimental conditions and parameters.

ISSUES

Report Prepared By	**Date**
Dr Andy Jones	06/21/05