Contribution ID: **233** Type: **Oral Presentation**

Multi-Dimensional Analysis of Precipitates in a 12% Cr Steel

Tuesday, 30 June 2015 15:00 (20 minutes)

Abstract content
   (Max 300 words)
Formatting &
Special chars

Creep-strength-enhanced ferritic (CSEF) steels are widely used in fossil fuel plants. This material is strengthened by M₂₃C₆ (M = Cr, Fe) and MX (M = V, X = C, N) precipitates in the tempered martensite matrix. The size, shape and distribution of these precipitates play an important role in the creep strengthening of the material, which is quantified by the Orowan back-stress. The precipitate parameters are often measured from images taken from thin-foils using the transmission electron microscope (TEM). Some problems associated with the thin-foil methods are overcome by preparing extraction replicas of the surface. 2D elemental maps are only projections of the 3D precipitates and therefore cannot sufficiently provide the spatial distribution of the precipitates. Transmission electron tomography is a technique capable of visualising the 3D structure of the precipitates. If combined with energy-filtered TEM (EFTEM), one can generate 3D chemical maps, which overcomes the limitations of the 2D maps. The aim is to use 3D elemental EFTEM maps obtained from the extraction replica, to determine the precipitate shape and spatial distribution. These results can then be compared to that previously obtained from the 2D maps.

The material used for this study was X20CrMoV11-1 (12% Cr) stainless steel. TEM thin-foils and extraction replicas were prepared. 2D EFTEM elemental maps were acquired for Cr and V using the TEM. In order to construct a 3D composite image, a tomographic tilt-series of EFTEM maps was obtained with the TEM.

From the results that will be presented, it can be concluded that by incorporating 3D EFTEM tomography with 2D elemental EFTEM mapping, that the projection limitation can be eliminated to obtain precipitate parameters with improved accuracy.

Apply to be
 considered for a student
   award (Yes / No)?

Yes

Level for award
 (Hons, MSc,
   PhD, N/A)?

MSc

Main supervisor (name and email)
and his / her institution

Prof. JH Neethling, Jan.Neethling@nmmu.ac.za, Department of Physics and Centre for HRTEM, NMMU.

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

Please indicate whether
this abstract may be
published online
(Yes / No)

Yes

Primary author: Ms DEYZEL, Genevéve (Centre for HRTEM, Department of Physics, NMMU, Port Elizabeth, South Africa)

Co-author: Dr WESTRAADT, Johan (Centre for HRTEM, NMMU, Port Elizabeth, South Africa)

Presenter: Ms DEYZEL, Genevéve (Centre for HRTEM, Department of Physics, NMMU, Port Elizabeth, South Africa)

Session Classification: DPCMM

Track Classification: Track A - Division for Physics of Condensed Matter and Materials