Quantitative Microstructural Analysis
Technical Work Area 37

VAMAS

CALL FOR PARTICIPATION

Project 4
Measurement of dislocation density in metallic materials by Transmission Electron Microscope (TEM)

Intersections-counting on the dislocation image

Determination of foil thickness by CBED method

Objectives

The aim of this international interlaboratory comparison is to determine the dislocation density in thin metals by using Transmission Electron Microscope (TEM).

The results will be used directly for further development of the **ISO/PWI 13139** „Microbeam analysis - Analytical electron microscopy - Measurement of the dislocation density in thin metals by TEM" with a validated measurement procedure, which will be optimised based on the results gained in this interlaboratory comparison.

Background

The dislocation is the physical nature of the deformation, and the dislocation density in metals is closely related to their strength and toughness. The dislocation density can be measured by TEM via an intersections-counting method, which can solve the 3D measurement by a 2D model.

Taking STEM images of a dislocation, counting intersections of a grid on the dislocation image and determining the thickness of the foil are the three key points of this method.

Standardization Needs

The TEM method to measure the dislocation is the most direct measurement procedure, and its result can be used as a reference for other indirect methods. A good dislocation image, which shall display as many visible dislocations as possible and have a homogenous background, is the basics of the intersections-counting method and can greatly facilitate the automation of the process of accurate counting. There are many parameters, such as sample condition, imaging method, etc., which will significantly affect the quantitative analysis results of the dislocation density. The manual counting of the dislocation intersections is time-consuming and troublesome. An automated counting method is recommended and also specified in the prepared measurement protocols in order to obtain reproducible results. It Based on the results gained in this interlaboratory comparison, the standardized measurement of the dislocation density in metals by TEM will be developed and included into the ISO 13139 project.
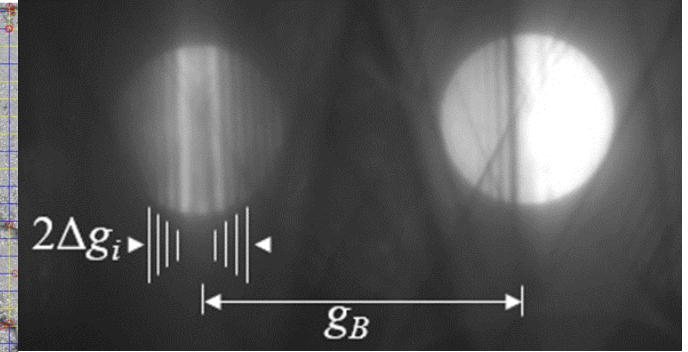
Relevant Standards Committee

ISO/TC 202/SC 3 Analytical Electron Microscopy
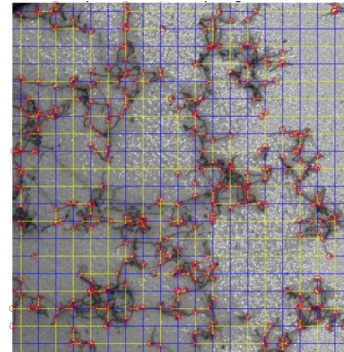
Work Programme

The dislocation density in a designated grain in the delivered foil sample will be measured by S/TEM, according to a protocol including the dislocation image acquisition and the foil thickness determination.

Sample will be prepared by the project leadership and provided to each participant.

The project is due to start in May 2024 for a duration of 9 months.

Deliverables and Dissemination

This interlaboratory comparison will be used to develop **ISO 13139** "Microbeam analysis - Analytical electron microscopy - Measurement of the dislocation density in thin metals".

Funding

Participants will fund their own involvement (approx. 1 day work).

International Participation

Current participation includes China. Additional participants are very welcome.

For more information:

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