

Project 3 Development of guidelines for reproducible TEM specimen preparation by focused ion beam processing

Objectives

The aim of this study is to develop guidelines for site-specific specimen preparation procedures using focused ion beam (FIB) processing for transmission electron microscope (TEM). Semiconductor single crystal Si and polycrystalline metals such as Cu and steels are considered as representative specimens. TEM specimen preparation is carried out using the proposed FIB processing procedure, and the thinning status is evaluated by TEM observations. The reproducibility of the FIB procedure to produce a similar thin lamella for TEM by any operator is investigated.

Background

FIB processing using Ga ion source is widely used as the TEM specimen preparation technique, including an application system as the TEM specimen preparation for the future semiconductor production line. The types of materials fabricated by the FIB range from semiconductors to metals, ceramics and even soft materials, resulting in different fabrication conditions. The users of FIB equipment range from beginners to experts, and it is important to establish best practice for consistent specimen preparation to enable improved reproducibility and reliability.

Standardization Needs

In order to fabricate reliable thin lamellae for TEM observations, it is desirable that a common FIB processing technique is established worldwide even if this applies only to some of the most commonly used specimens.

- 1) Si single crystals and typical metal polycrystals such as Cu and others are considered as model ones.
- 2) Development of guidelines for FIB fabrication procedures that enable any operator to prepare the site-specific thin lamellae for TEM observation with the same quality.
- 3) By having fabrication procedure reported, important parameters in the FIB processing will be extracted.
- 4) TEM observations of specimens prepared by the FIB processing are evaluated with regard to the FIB processing damage.

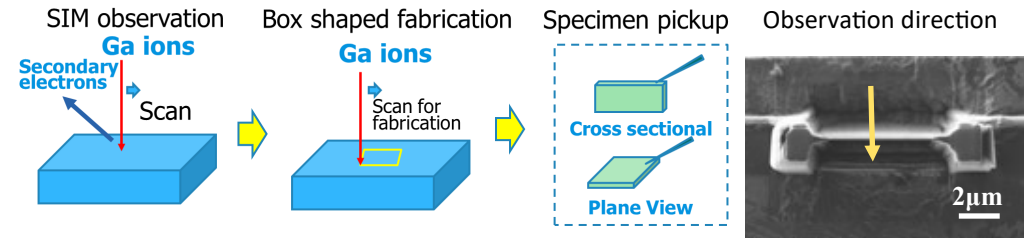
Relevant Standards

ISO/NP 17297 FIB Vocabulary
[ISO/TC202/SC1](#) - in progress

Relevant Committees

ISO/TC 202-Microbeam analysis
ISO/TC 201-Surface analysis
ISO/TC 229-Nanotechnologies

CALL FOR PARTICIPATION



Basic procedure for TEM specimen preparation using FIB system. Pre-deposition of protection layer is generally required for pick-up the area selected. Minimizing of damage layer thickness on specimen surface is also required for the reliable TEM observation.

SIM image of TEM specimen on final thinning process by FIB fabrication.

Work Programme

- **Sept 22:** Specimens will be delivered to participants along with the protocols.
- **Oct/Nov 22:** FIB processing of thin lamellae and successive TEM observation will be undertaken by the participants in accordance with the protocols provided.
- **Dec 22:** Data submission and analysis
- **Mar 23:** Guidelines for reproducible TEM specimen preparation will be established.
- **Apr/May 23:** Discussions of the next phase development.

Deliverables & Dissemination

- Results disseminated in a peer-reviewed scientific journal.
- Key guidelines for TEM specimen preparation by FIB will be established by the ISO in the [TC 202/SC3](#).

Funding

Participants fund their own involvement in the project.

Project Status

The project is due to start in August 2022 for a duration of 12 months.

For more information:

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