VAMAS

Project A43

Determination of experimental parameters for quantitative MEIS analysis

Objectives

This project aims to establish experimental parameters that must be defined when measuring MEIS for quantitative analysis.

Background

As industrial films become thinner down to a few nano-meters, the use of surface analysis techniques such as SIMS, XPS, and MEIS is increasing. Especially, the increasing use of ultra-thin film is creating a new and growing demand for MEIS analysis. This is because MEIS analyzes the composition depth profile without sputtering and provides the depth profile and interface information of ultra-thin films with very little ion beam damage.

Standardization Needs

The first standard for MEIS (ISO 23170) was published in 2022, and was about stopping power used in the analysis process. Through this standard, standard deviations of thickness, composition, and quantity was generally improved from 5.3% to 7.3% for composition, from 15.3% to 4.5% for thickness, and from 13.3% to 7.0% for Hf content using the stopping power measured in the analysis.

MEIS results are obtained through measurement and analysis, and measurement conditions must also be standardized to ensure more valid results in addition to the standardization of analysis. Because, valid MEIS results depend both on measurement and analysis.

- ISO 23170
  Non-destructive depth profiling of nanoscale Heavy Metal Oxide Thin Films on Si Substrates with Medium Energy Ion Scattering

Here, an interlaboratory study on MEIS measurement of PtNi alloy samples using well defined experimental parameters is proposed. Through this ILC, standardization of MEIS measurement condition adjustment procedures for quantitative analysis will be established.

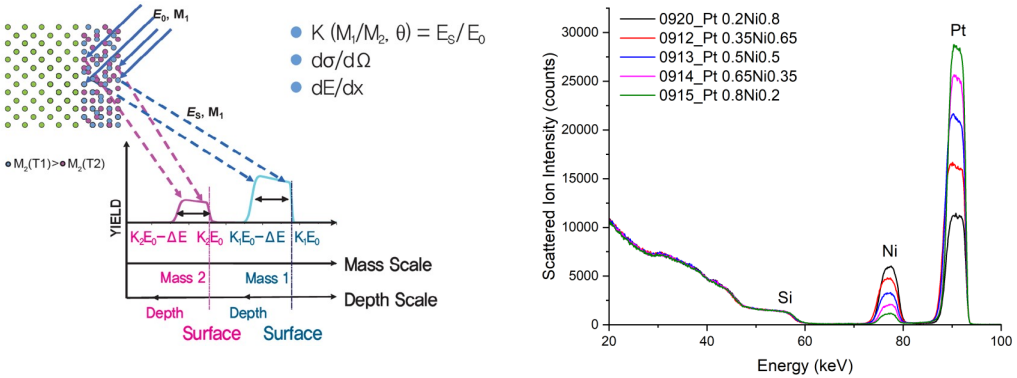
Work Programme

The relevant procedures for defining appropriate measurement parameters for MEIS analysis are developed after proceeding with the following protocol.

- defining incident ion energies and scattering angles using the spectral leading edges in MEIS spectrum of multi-element thin film samples.
- Adequate detector voltage adjustment that results in spectral height saturation as detector voltage increases
- Check peak height saturation as current decreases to ensure no multiple hits
- After the 4 parameters are well defined, Pt_xNi_{1-x} alloy (x=0.2, 0.35, 0.5, 0.65, 0.8) samples will be measured.

From these ILC results, a standard measurement protocol will be defined.

Call for Participation



MEIS schematic and spectral examples of PtNi alloy samples for ILC

Project Status

Pt_xNi_{1-x} alloy (x=0.2, 0.35, 0.5, 0.65, 0.8) samples for ILC and TaTiSiOx on DLC samples and SW, which will be used to find the incident ion energy and scattering angle were disseminated to the first round of participants.

Deliverables and Dissemination

- Reference methods
- Test procedures
- Publications in scientific journals

A future ISO TC201 standard is also a possibility.

Funding

Participants will fund their own involvement.

International Participation

Current participation includes R.O. Korea, Canada, Brazil, UK, and European countries. Additional participants are welcome.

For more information:

Dr. WonJa Min (Project Leader)
Hb solution, R. O. Korea
wj.min@hb-solution.co.kr

Prof. Ian Gilmore (Chair, TWA 2)
NPL, UK
ian.gilmore@npl.co.uk

www.vamas.org

December 2024