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von

Lidija Matjacic

University of Surrey Ion Beam Centre, GU2 7XH, UK

International Atomic Energy Agency, Division of Physical and
Chemical Sciences, 1220 Vienna, Austria

Molecular Analysis with Ambient Pressure MeV-SIMS

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Molecular Analysis with Ambient Pressure MeV-SIMS

L.Matjacic^{1*}, J. Demarche², V.Palitsin¹ & R. Webb¹

¹University of Surrey Ion Beam Centre, GU2 7XH, UK

²International Atomic Energy Agency, Division of Physical and
Chemical Sciences, 1220 Wien, Austria

email: l.matjacic@surrey.ac.uk

Abstract

MeV Secondary Ion Mass Spectrometry is an analytical technique which can provide us with information on molecular and elemental composition, depth profile and is also used for obtaining molecular concentration images of surfaces. Unlike in keV SIMS, where energy is being deposited into nuclear system, in MeV SIMS sputtering occurs via electronic system. MeV ions have a relative high probability of desorbing large intact molecules (up to 10kDa) from a surface compared to keV ions. Furthermore, MeV ions can be extracted into the air, where travel few millimetres with most of its focus retained. This is a very significant difference in comparison to keV ions which opens a possibility for performing analysis under ambient conditions.

An ambient analysis does not require a sample preparation; hence the sample can remain in its original state. Consequently, the analysis will be less time consuming and even cheaper. Chemical effects of vacuum will not occur, and because a demand for fitting the sample into a vacuum chamber does no longer exist, it can retain its original size and shape. Therefore, Ambient Pressure MeV SIMS can be used for analysis of cultural heritage, forensic and environmental analysis, beside traditional usage of keV SIMS which is for material and surface analysis. Beside the chemical analysis, elemental analysis can also be accomplished by performing simultaneously PIXE or RBS. Nevertheless, mapping can be performed and obtained a complete 3D image of the targeted material with high spatial resolution going sub-micron. This is a very important feature, knowing that most of Atmospheric Pressure Mass Spectrometric techniques are limited in achieving spatial resolutions better than few tens of microns (MALDI, DART, DESI).

At University of Surrey Ion Beam Centre first Ambient Pressure MeV SIMS system has been commissioned. Here, the set-up will be described and some of preliminary results presented. Numerous challenges of carrying out the analysis under atmospheric conditions will be depicted, and experience on sample handling will be shared.

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Working Experience:

- **2013** - Marie Curie Early Stage Researcher on SPRITE project, (under EC contract no. 317169)
- **2010 -2012** FP7 project UNCOSS (Underwater coastal sea surveyor) at Department for Experimental Physics, Ruđer Bošković Institute in Zagreb, Croatia

Education:

- **2014** – PhD in Electronic Engineering, University of Surrey, UK
- **2003 – 2009** MSc in Chemistry, Faculty of Natural Sciences in Zagreb, Croatia

Publications:

- Evaluation of elemental composition of sediments from the Adriatic Sea by using EDXRF technique
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Applied Radiation and Isotopes 70 (2012) 1392–1395
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