
**Surface chemical analysis —
Secondary ion mass spectrometry
— Method for determining yield
volume in argon cluster sputter depth
profiling of organic materials**

*Analyse chimique des surfaces — Spectrométrie de masse des ions
secondaires — Méthode de détermination du rendement volumique
dans le cadre du profilage en profondeur de matériaux organiques
par pulvérisation d'argon en grappe*

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 201, *Surface chemical analysis*, Subcommittee SC 6, *Secondary ion mass spectrometry*.

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Introduction

In many technological and biological samples, it is necessary to understand the distribution of organic chemical species as a function of depth and to combine this with laterally resolved surface chemistry to provide three-dimensional representations. Secondary ion mass spectrometry is a method capable of determining depth distribution combined with lateral information. Argon cluster ion beams can provide sputter depth profiles through most organic materials without causing significant damage and molecular species may be detected and located by mass spectrometry. This approach can provide depth resolutions better than 10 nm and depth profiles which extend over many micrometres in thickness. In order to reconstruct a depth profile or three-dimensional image, it is important to establish the depth scale in the depth profiling experiment. For this purpose, the sputtering yield volume is required.

The sputtering yield volume defines the ratio between the areic dose of sputtering ions and the sputtered depth. Knowledge of the sputtering yield volume enables the depth of features of interest to be determined from the sputtering ion current, the sputtered area and the sputtering time. The sputtering yield volume depends upon the specific experimental conditions such as the sample temperature, the material being sputtered, the cluster source identity, kinetic energy and angle of incidence. However, the prediction of sputtering yield volumes for a particular material is possible using measurements made from the same material under different experimental conditions. Therefore, reliable measurements of sputtering yield volumes are required for accurate measurement of depth, to provide comparability between laboratories and to enable analysts to implement and use sputtering yield volumes reported by others.

This document provides methods to measure sputtering yield volumes of organic test materials using argon cluster ions. The test materials should consist of thin films of known thicknesses between 50 nm and 1 000 nm. The format of the test materials, the measurement of sputtering ion dose, sputtered depth and reporting requirements for sputtering yield volumes are described. [Annex A](#) provides informative definitions of sputtered area and sputtering beam width and an example of their measurement. [Annex B](#) provides informative examples of typical depth profiles and an example calculation of sputtering yield volume. [Annex C](#) provides informative methods to estimate sputtering yield volumes under different sputtering conditions.

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