NEWS RELEASE

Hamamatsu Photonics has newly developed ionization-assisting substrates that will drastically reduce the pretreatment time in imaging mass spectrometry.
Samples of this product will be available from May 11, 2018.

May 10, 2018
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Hamamatsu Photonics has newly developed ionization-assisting substrates called the DIUTHAME series. DIUTHAME is an acronym for Desorption Ionization Using Through Hole Alumina MEmbrane that utilize porous alumina to drastically reduce the pretreatment time needed for ionizing a sample or analyte to be analyzed by imaging mass spectrometry. To complete sample-pretreatment for mass spectrometry, all one has to do is place the DIUTHAME substrate on the sample. This shortens the pretreatment time to about one tenth that of Matrix-Assisted Laser Desorption/Ionization or MALDI which is a mainstream ionization technique for mass spectrometry. DIUTHAME is also usable for measurement with existing MALDI-TOF-MS. Sample DIUTHAME products will be available from May 11 (Friday), 2018, mainly to researchers in companies and universities in Japan and overseas who are currently using MALDI-TOF-MS in drug discovery and industrial fields.

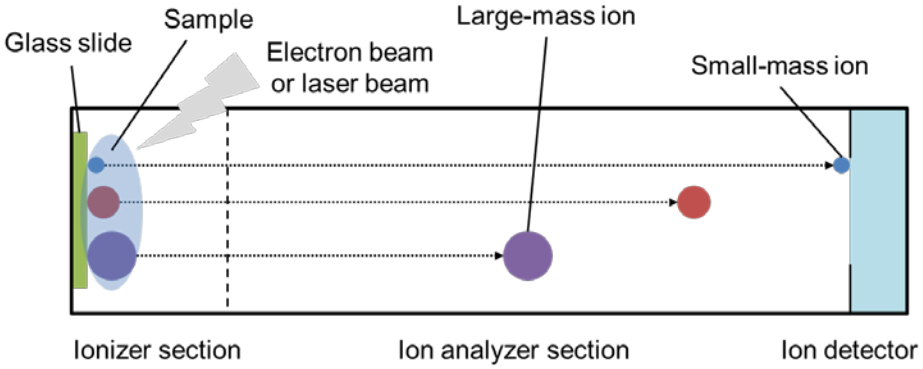
DIUTHAME was jointly developed with the help of Associate Professor Yasuhide Naito, the Graduate School for the Creation of New Photonics Industries (Hamamatsu, Japan). DIUTHAME will be on display at the ASMS (American Society for Mass Spectrometry) Conference 2018 to be held in the San Diego Convention Center (California, USA) for 5 days from June 3 (Sunday) to June 7 (Thursday).

※Porous alumina: Aluminum oxide having uniformly arranged fine through-holes.

※TOF-MS: Time-of-flight mass spectrometer used to measure mass based on the time taken for an ion to travel a given distance.

< Brief look at mass spectrometry >

Mass spectrometry is a high-precision analytical technique that determines the type and quantity of atoms and molecules contained in a sample and also their molecular structures by means of ionizing the atoms and molecules in the sample by irradiation with an electron beam or laser beam or other means and then measuring the mass of each ion. A mass spectrometer basically consists of an ionizer section for ionizing a sample, an ion analyzer section for separating the ions, and an ion detector for detecting the separated ions. Mass spectrometers are combined with various ionization and ion analyzing methods depending on the sample and are used in a wide range of fields such as environment, food, chemistry, forensic medicine, and life science.



Basic principle of mass spectrometry

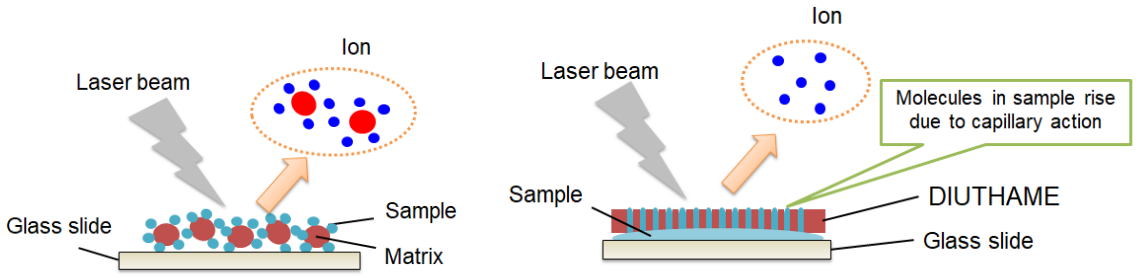
< Background of development >

MALDI or Matrix-Assisted Laser Desorption/Ionization is a technique for ionizing a sample by irradiating it with a laser beam, used in mass spectrometry. The sample for MALDI mass spectrometry is pre-mixed with a low-molecular-weight organic compound called a matrix that absorbs the energy of the laser. Besides being able to ionize a sample without destroying the structures of biopolymers such as proteins, which has been very difficult up until now, MALDI acquires information on the mass and positions of the ions at the same time, allowing imaging mass spectrometry that simultaneously analyzes the mass and visualizes the distribution state of the components of the sample. These MALDI features make it a promising tool especially in the fields of life science and drug discovery. However, MALDI imaging mass spectrometry usually requires about 30 minutes for pretreatment for matrix preparation, applying and drying. In addition, applying the matrix uniformly on the sample requires skill. These problems show the need for another ionization technique that does not use any matrix.

< Overview of DIUTHAME >

DIUTHAME is an ionization-assisting substrate using a porous alumina containing through-holes of roughly 200 nanometers (1 nanometer equals a billionth of a meter) in diameter developed for imaging mass spectrometry. When the DIUTHAME substrate is placed on a sample, the molecules in the sample rise to the surface by capillary action. Irradiating those molecules with a laser beam ionizes the molecules without destroying their structures. This ionization technique does not use any matrix and so makes sample-pretreatment easy and simple for imaging mass spectrometry. This time, in addition to DIUTHAME with an effective diameter of 17 mm for imaging mass spectrometry, we have also developed DIUTHAME with an effective diameter of 2 mm suitable for general-purpose mass spectrometry that does not need positional information. Porous alumina has already been used for coloring of aluminum sashes and other applications and we have succeeded in developing DIUTHAME by employing porous alumina as the material for ionization-assisting substrates.

※Capillary action: A phenomenon in which liquid rises in a thin tube.



MALDI　　Laser ionization using DIUTHAME

In the MALDI process, ionization occurs by laser irradiation on a sample pre-mixed with matrix.
In the DIUTHAME process, ionization occurs by laser irradiation on molecules in the sample that rise to the surface of the substrate due to the capillary action of the porous alumina.

DIUTHAME allows easy pretreatment by just placing the ionization-assisting substrate on a sample. The molecules in the sample then rise to the surface of the substrate while retaining the sample's positional information, and so unlike the MALDI process, there is no process for uniformly applying matrix. This ensures quick sample-pretreatment for imaging mass spectrometry, which completes in about 3 minutes and also requires no skill or experience usually needed for applying matrix, making it possible to obtain measurement results with high reproducibility. Since DIUTHAME does not use any matrix that will be ionized along with the sample, low-molecular-weight samples, which are not suitable for MALDI measurements, can also be measured with high accuracy. DIUTHAME is usable on existing MALDI-TOF-MS measurement plates and so will improve R&D efficiency in drug discovery and industrial fields where MALDI-TOF-MS is currently used. By further improving the structural design and other factors, we will continue developing new DIUTHAME products with higher ionization efficiency that will meet a wide range of expanding applications.

< Features of DIUTHAME >

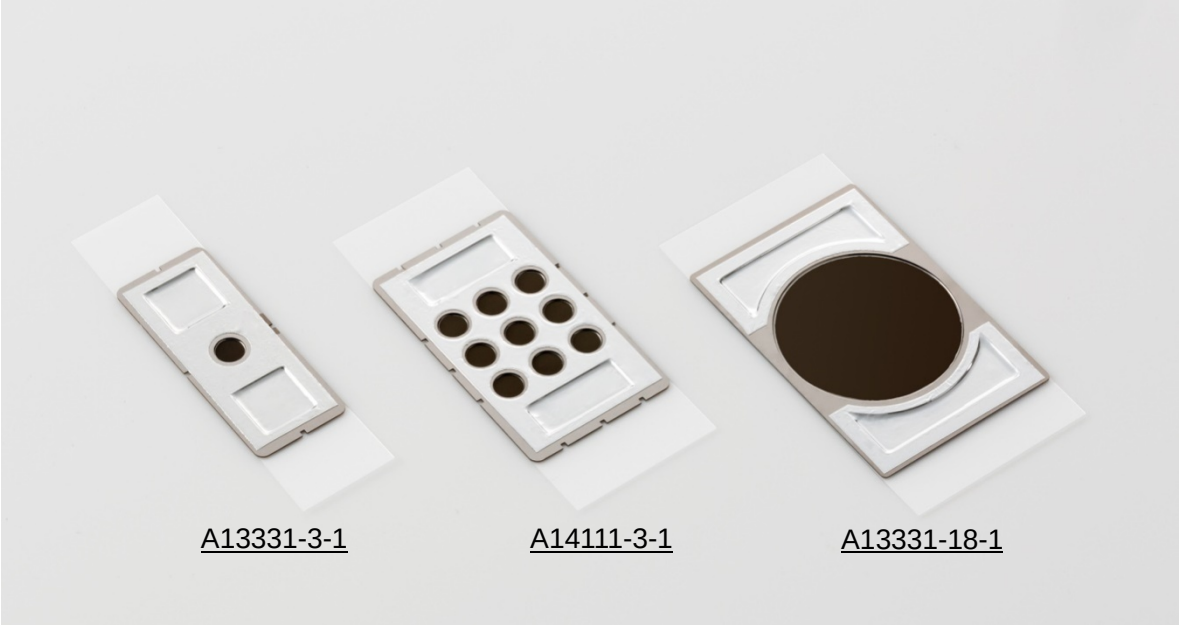
1. Shortens the sample-pretreatment time for imaging mass spectrometry to one tenth the usual time
   Pretreatment for imaging mass spectrometry will be quick and easy — just place the DIUTHAME substrate on the sample. The sample-pretreatment time, which usually takes 30 minutes for MALDI, can now be shortened to about 3 minutes.

2. Allows imaging mass spectrometry with high reproducibility
   Since pretreatment for imaging mass spectrometry quickly completes in a short time just by placing the DIUTHAME substrate on a sample, it needs no process for uniformly applying matrix such as in the case of MALDI, which requires both experience and skill. This eliminates variations in pretreatment and allows obtaining measurement results with higher reproducibility compared to MALDI imaging mass spectrometry.

3. Measures low-molecular-weight samples
   Unlike MALDI, DIUTHAME does not use any low-molecular-weight matrix that will be ionized along with the sample. This means that it can make high-accuracy measurements of low-molecular-weight samples such as industrial materials and anti-doping drugs which are not suitable for MALDI mass spectrometry.

● Main specifications

Item	A13331-18-1	A13331-3-1	A14111-3-1	Unit
Applications	Imaging mass spectrometry	Mass spectrometry	Mass spectrometry	-
Number of channels	1	1	9	-
Channel diameter	18	3	3	mm
Minimum effective diameter	17	2	2	mm
Dimensions (W×L×D)	30×20×0.3	25×10×0.3	27×16×0.3	mm



Ionization-assisting substrates DIUTHAME series