Organic LED imaging by AP/MALDI(ng) UHR / Orbitrap HRMS

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INTRODUCTION

MassTech *AP/MALDI(ng) UHR* module is a flexible add-on ion source for existing Thermo LC/HRMS equipment. This Application Note presents AP-MALDI MS analyses and imaging of an OLED display based on a Thermo *LTQ/Orbitrap Elite* instrument.

WORKFLOW

Sample Preparation:

1) A broken smartphone was disassembled to access the OLED panel
2) A portion of the Display was cut and adapted on MassTech Glass Slide holder and adjusted with spacers to meet the standard working distance
3) The homogeneous protective layer was removed using sticky tape

Data Acquisition:

1) Definition of image parameters (CSR mode, image dimension 500 x 500microns, 10 micron pixel size) in MassTech *Target* (a control software)
   → Parameters are saved as .xml file
2) Molecular imaging using *AP/MALDI(ng) UHR* ion source (MassTech) with *LTQ/Orbitrap Elite* (Thermo) high resolution MS
3) Data handling with *ImageQuest* (Thermo) using native files (XML and RAW files)

Fig.1: MassTech AP/MALDI(ng) UHR add-on source

KEY CHARACTERISTICS AND BENEFITS

- MALDI imaging capabilities down to 10 micron lateral resolution
- Switch from the AP-MALDI configuration to LCMS configuration within 5 minutes.
- Provides MALDI analysis and imaging capabilities to high-end LCMS instruments
- Laser focus can be adjusted from 10 to 30 microns

Available modes of operation

- Sequential MALDI MS analysis of multiple sample spots on AB Sciex *OptiTOF 192* or Bruker *MTP96* MALDI target plates using spiral or raster motion with tunable parameters
- MALDI MS imaging using Pixel-Map mode, with tunable in-pixel motion for various tissue MS analyses (HRMS, SRM, etc).
- MALDI MS imaging using Constant Speed Raster (CSR) mode for increased pixel data acquisition rates

Case Study:
AP-MALDI UHR imaging capability has been applied for OLED ingredients MS imaging using a Thermo HRMS equipment. High lateral resolution image was demonstrated using spot size below 10 micrometers to produce MALDI MS images over a field of view of 500 μm x 500μm (Fig. 2).

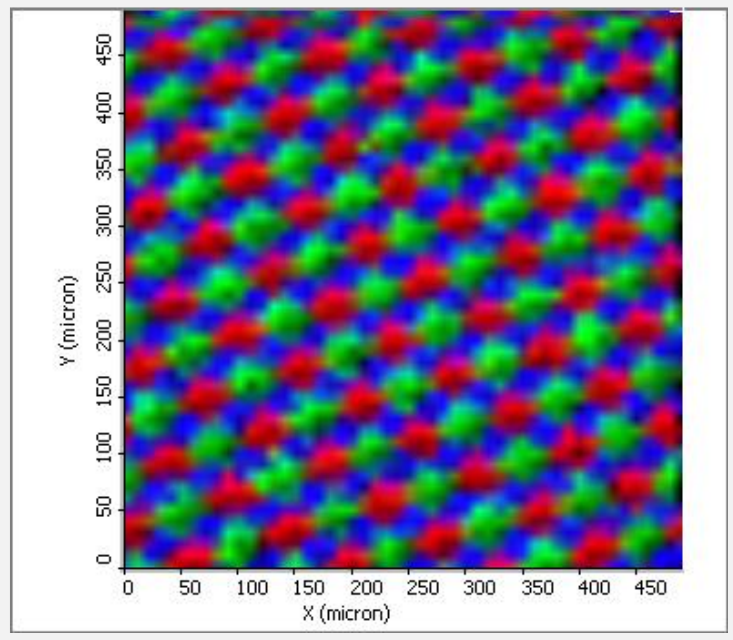

Fig.2: MassTech AP/MALDI(ng) UHR imaging of a portion of an OLED display (R: m/z=638.2685, G: m/z=729.2635, B: m/z=675.2890)

Ingredient identifications:
AP-MALDI UHR imaging allows for accurate mass measurement of ions produced from a 10μmx10μm spot size (within +/-3mDa without lockmass). Structural confirmation may be obtained from simultaneous in-pixel MS/MS analysis.

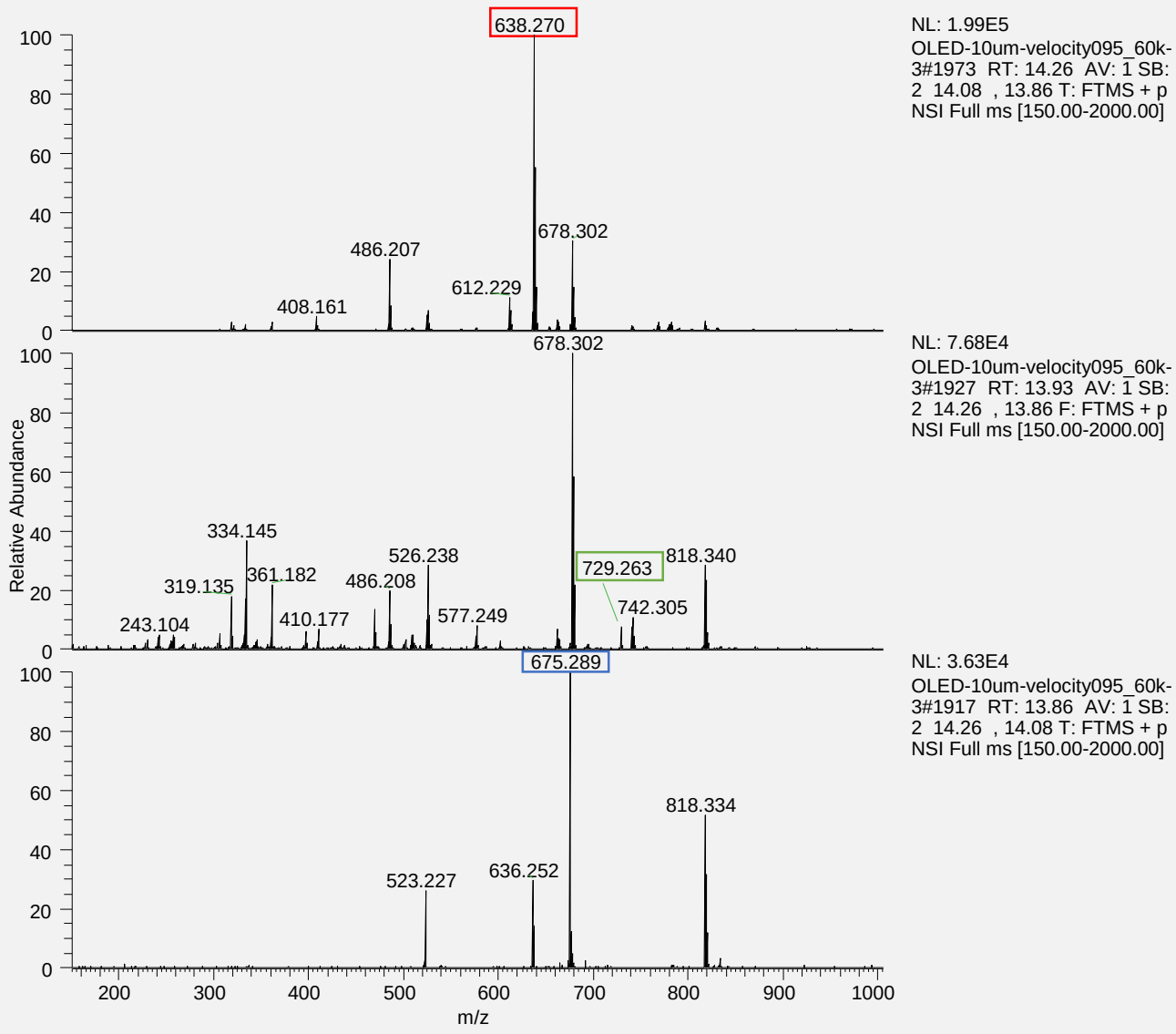

Fig.3: Differential Single scan High-Resolution mass spectra extracted from areas in Red (top), green (middle) and Blue (bottom) in Fig.2. based on background subtraction feature in XCalibur

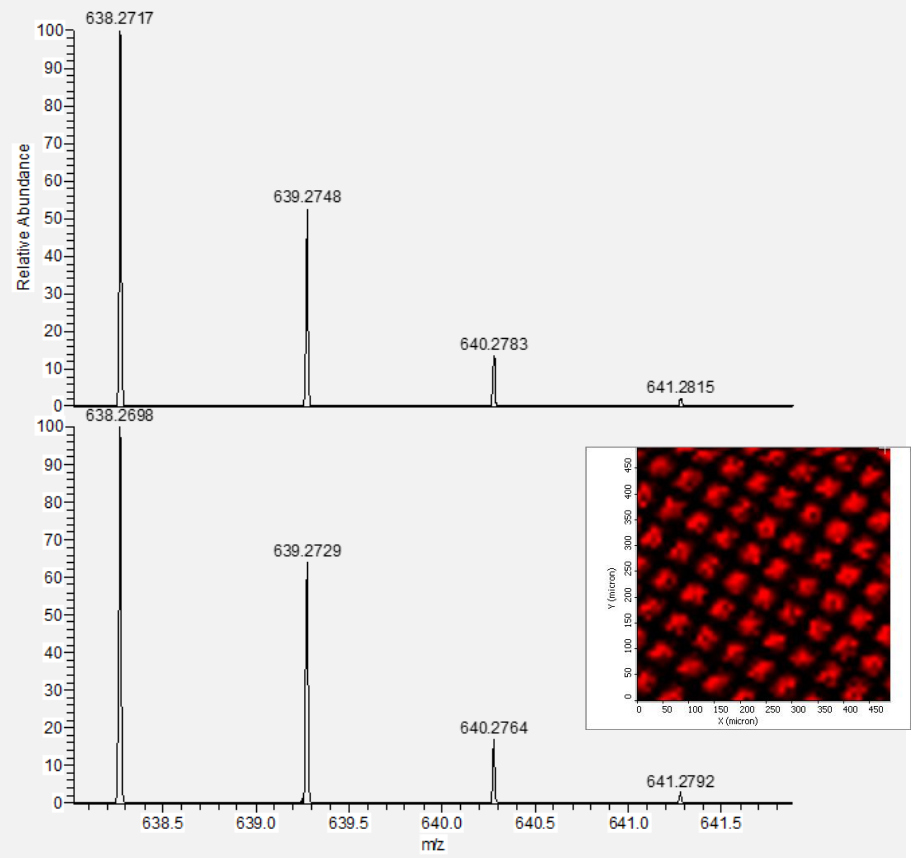

Fig.4: Tentative assignment of m/z=638.270 detected in areas in Red in Fig.2. (calculated MS for $C_{48}H_{32}N_2^+$ (top) vs. experimental spectrum and its AP-MALDI HRMS image (bottom)

AP-MALDI HRMS Imaging reveals molecular contrasts from single 10μmx10μm areas. Application to organic microelectronics may be useful to study aging effects or failures.

MassTech offers a range of analytical ionization sources, accessories and complete instruments for advanced analytical platforms. An AP-MALDI UHR ion source is available worldwide exclusively from MassTech and authorized resellers, such as KR Analytical in Europe (www.kranalytical.co.uk).

To request further information, please contact:
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MassTech selected LIST as European Application Lab: www.list.lu

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