# Electrochemistry meets Imaging –

# Electrode Surface Analysis by means of MALDI-ToF-MS

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## Applications of electrochemistry

### Energy storage

- efficient energy storage
- longevity of battery cells
- different types of electrolytes and electrodes
- safety aspects

### Electroorganic synthesis

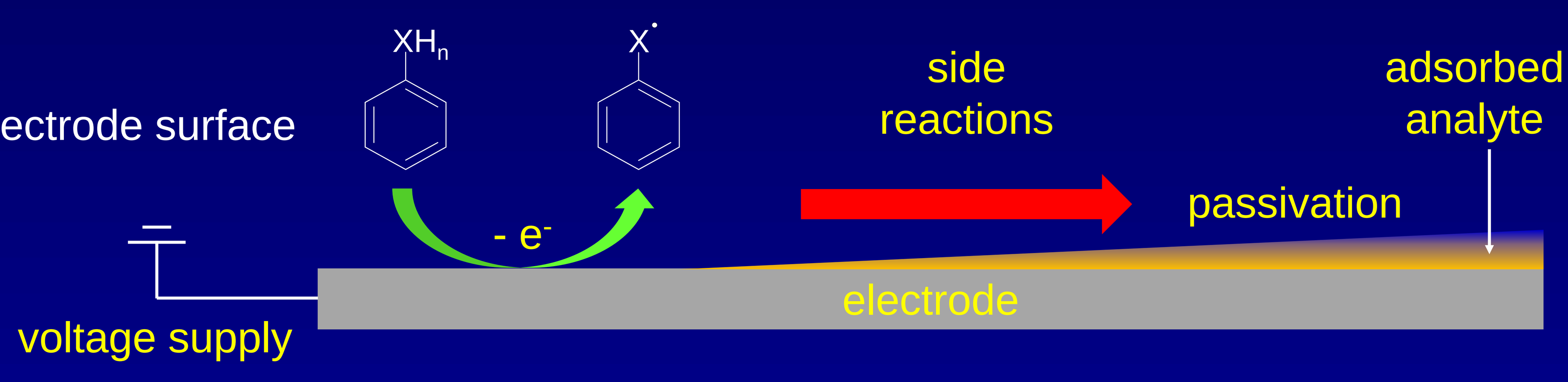
- electrochemistry as reaction initiator
- single-electron transfer (SET) reactions
- emerged as valuable tool in organic synthesis
- „green chemistry“

### Analytical applications

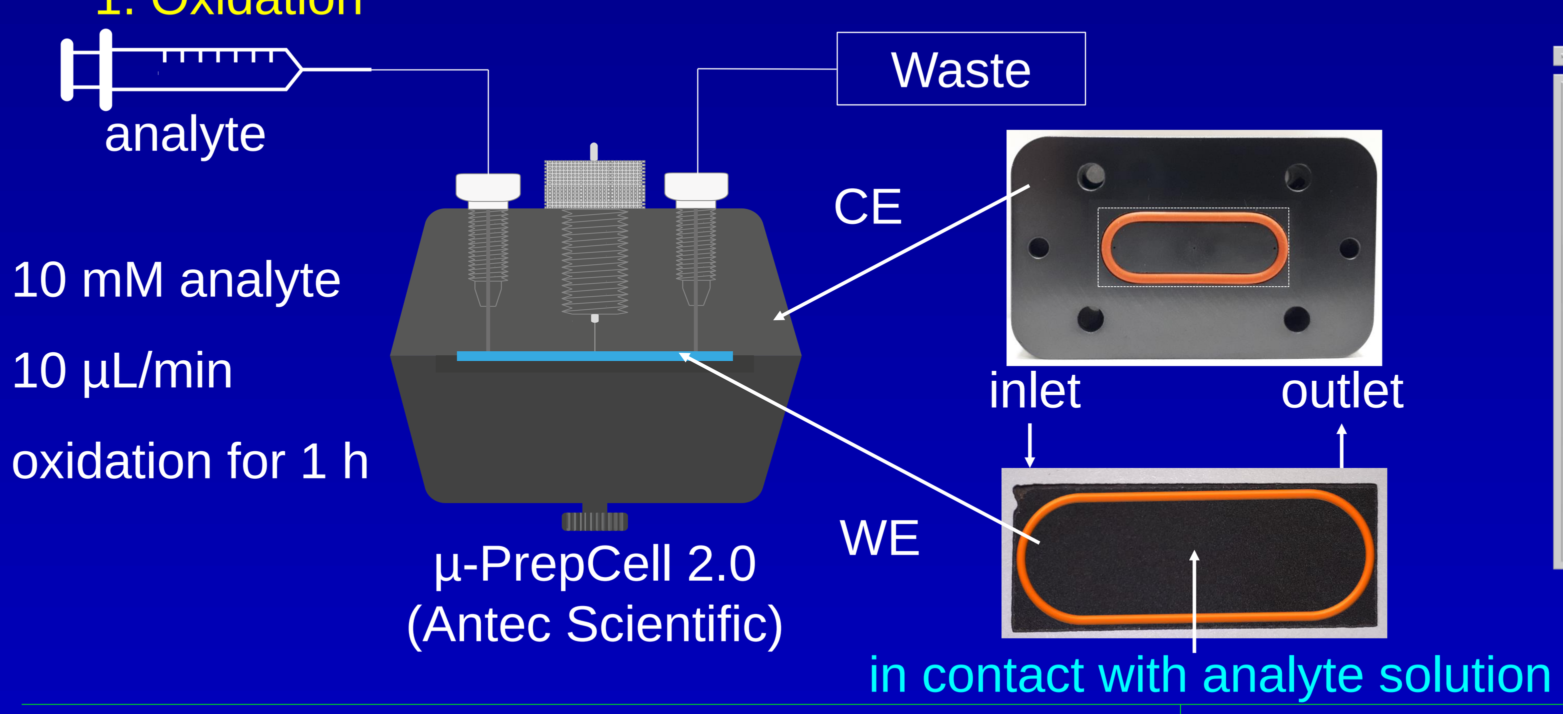
- electrochemical detection methods
- electrochemistry as simulation tool for phase-I metabolism
- successful mimicking of oxidative *in vivo* transformation of pharmaceuticals

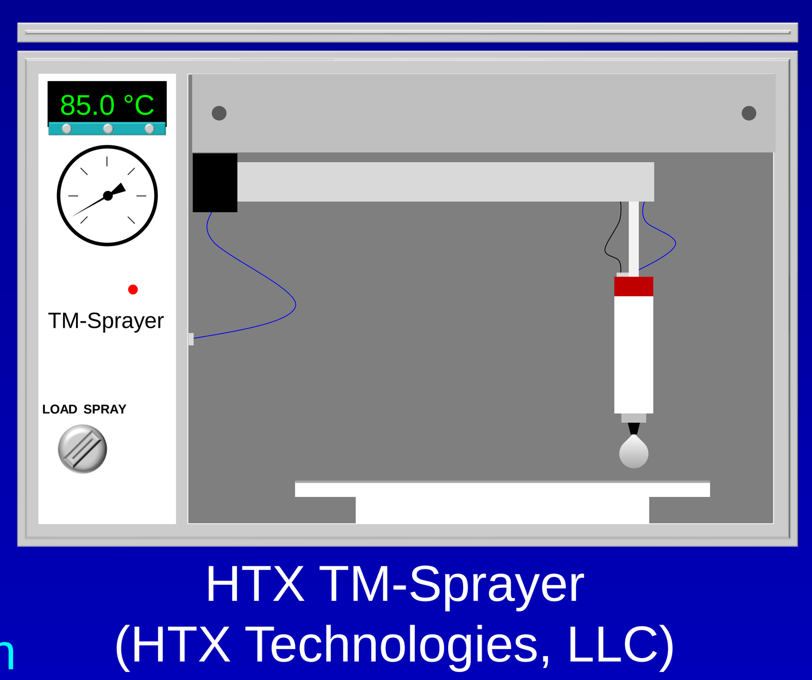
## Electrode fouling

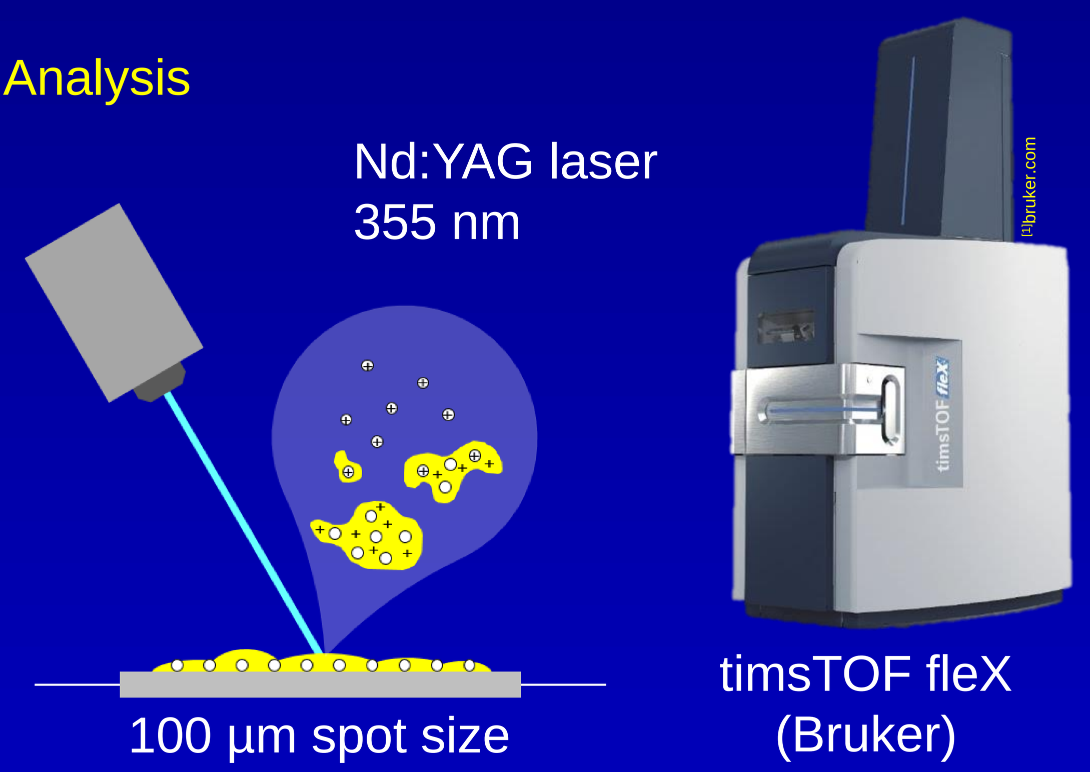
- electrode “fouling” as major challenge to guarantee reproducibility
- possible adsorption of analyte molecules may lead to deposition on the electrode surface
- side reactions, e.g., polymerization
  - → passivation of the electrode surface
  - → intensity drop or even changes in reaction behavior

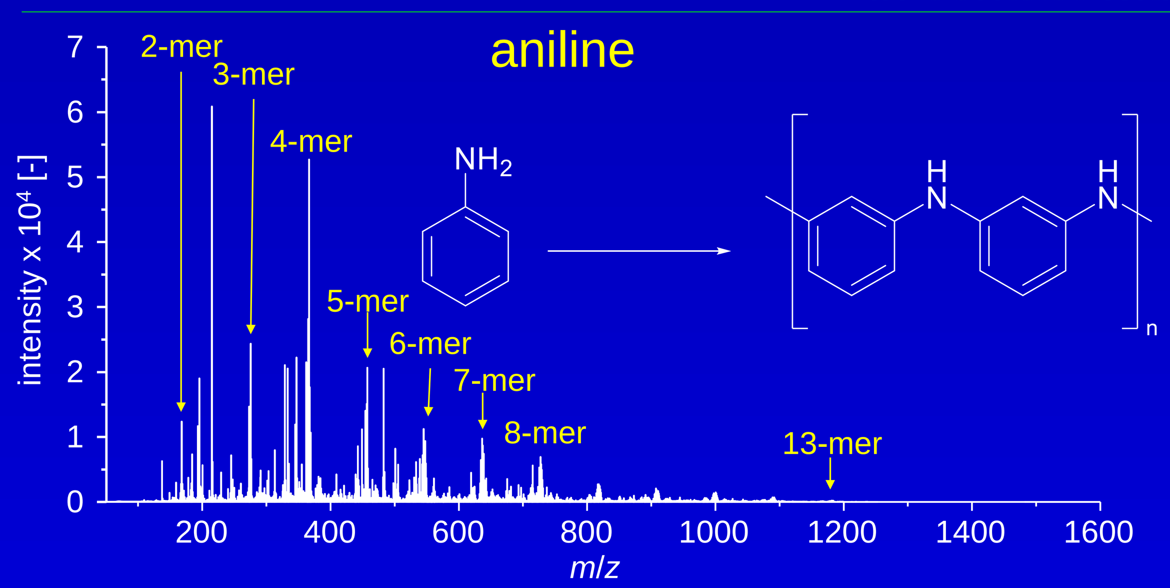


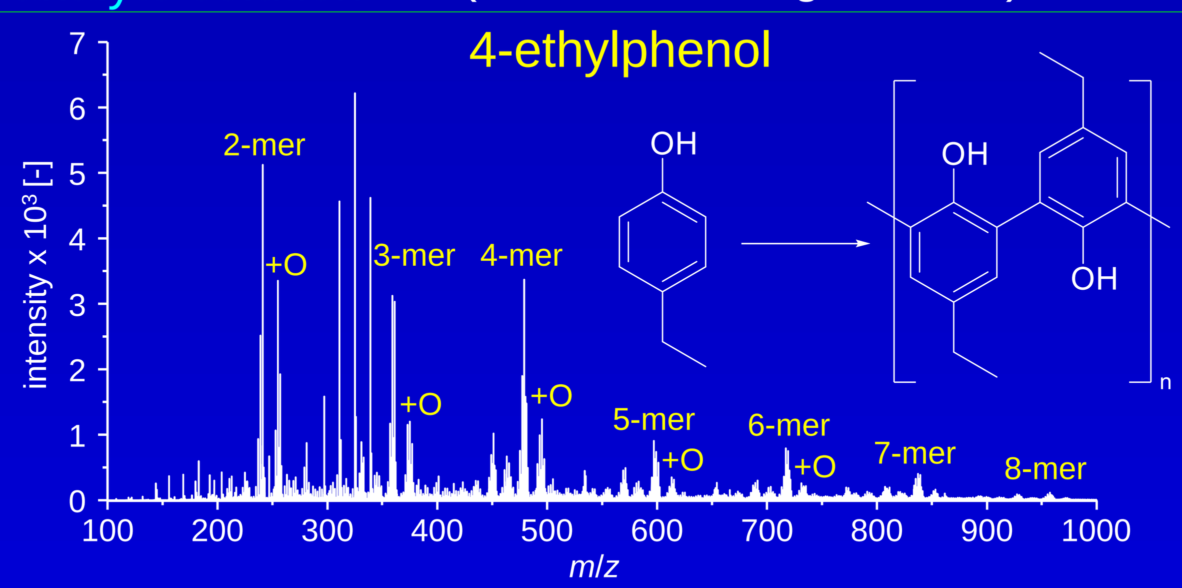

## MALDI imaging of BDD electrodes

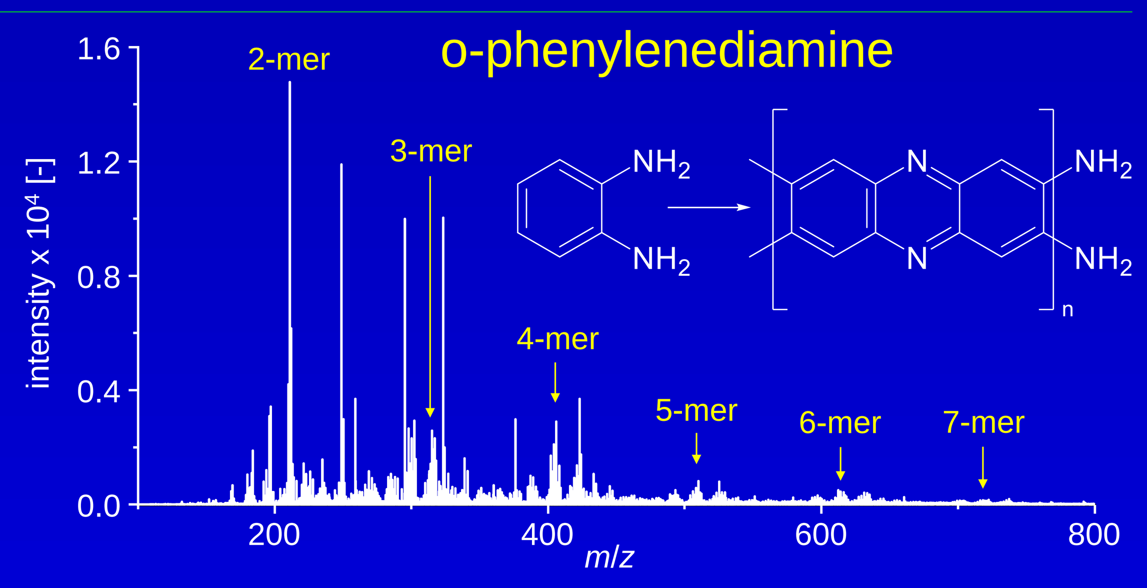


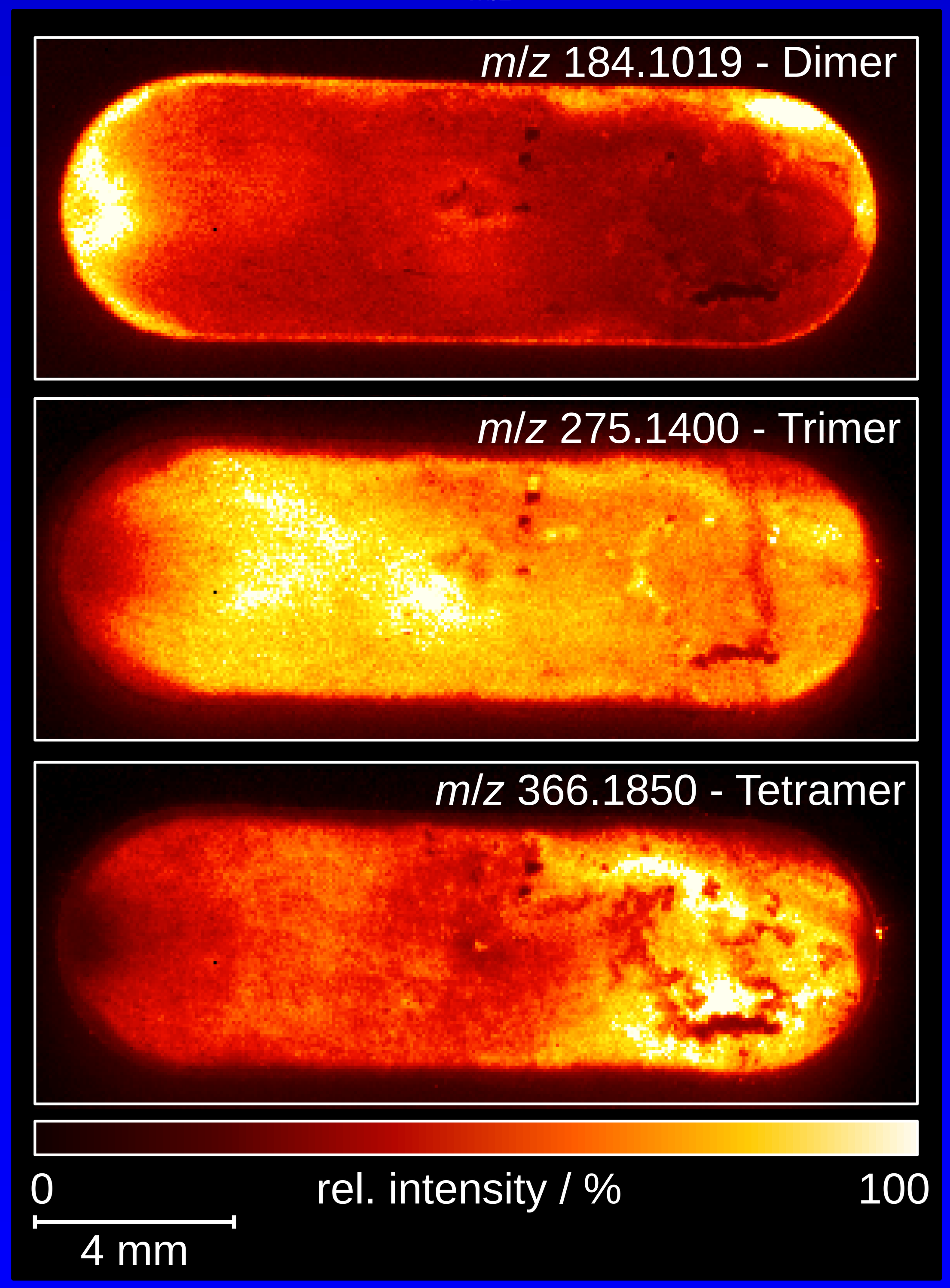



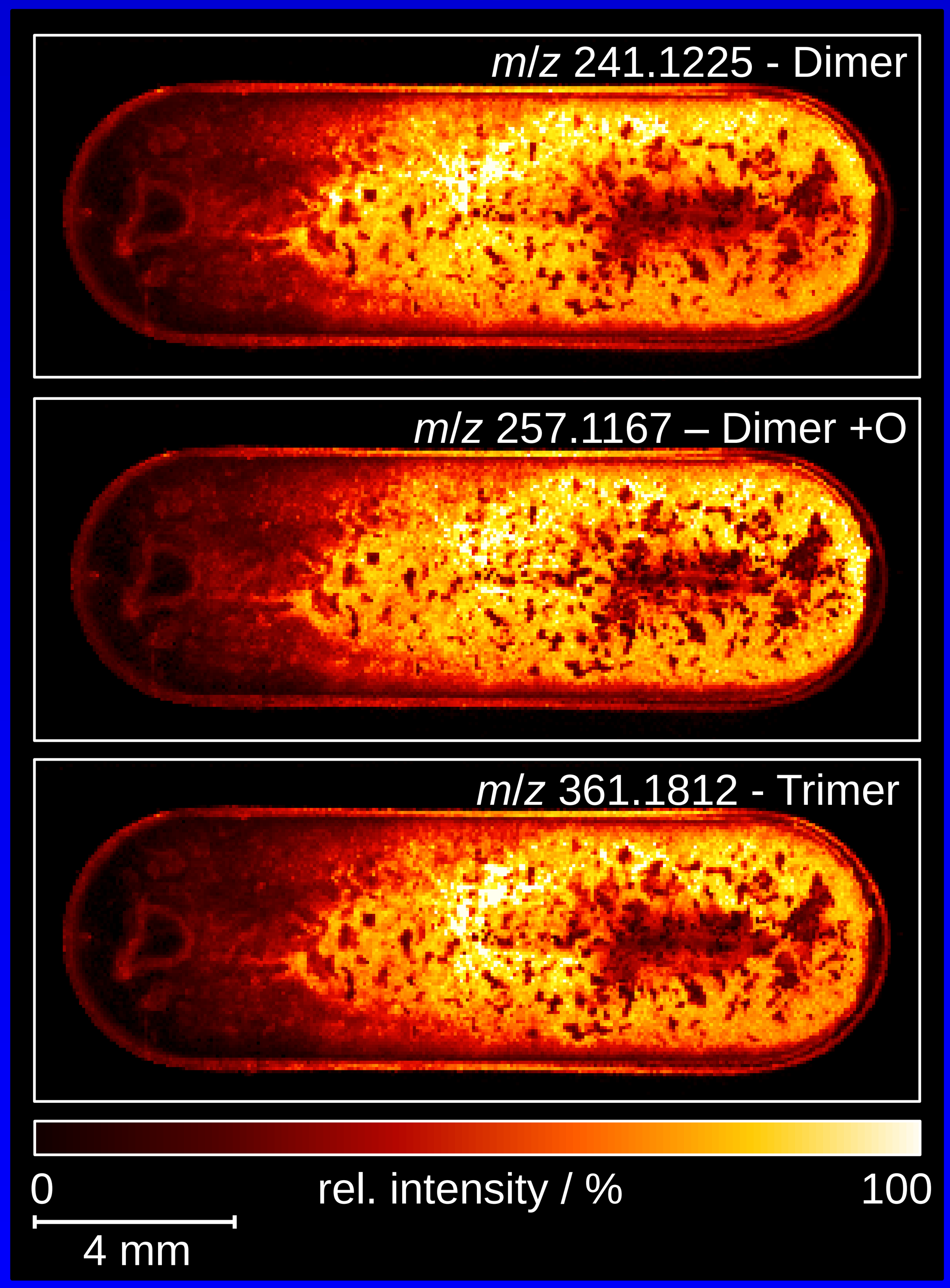



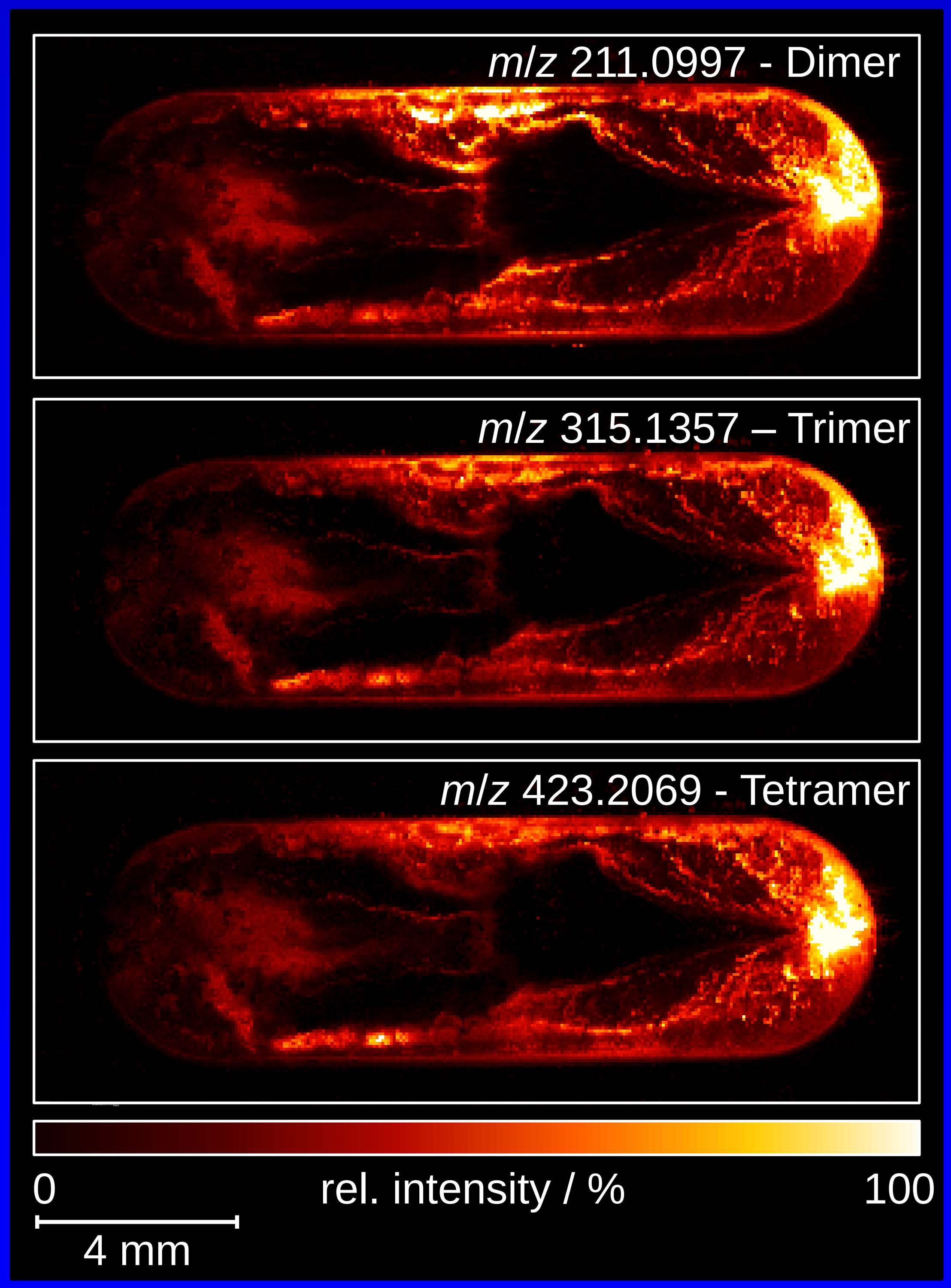




## Conclusions

- electrochemical oxidation of three organic molecules
  - → polymerization of all three investigated compounds
  - → formation of up to 17-mer has been observed
  - → adsorption on the electrode surface
- formed oligomers are accessible with MALDI-ToF-MS, some of them without matrix application
  - → oligomer size distribution differs over the whole electrode reaction surface
  - → dependency on the flow direction, and therefore contact time can be visualized
  - → MALDI imaging helps identifiying “weak spots” during the electrochemical process