Simplified Operation of Thin Surface-induced Dissociation Devices

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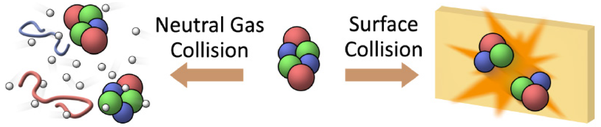
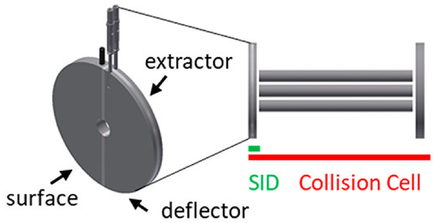
Introduction and Background

- Surface-induced dissociation (SID) involves ion – surface collisions instead of ion – neutral collisions.[1]



- SID causes native-like protein complexes to dissociate at the weakest subunit interfaces, revealing information about subunit connectivity and topology.[2]
- Thin SID devices feature electrodes occupying ~3 mm along the ion beam instead of 1.5 – 3 cm.[3]



- Thin SID devices have 3 independent electrodes which simplifies tuning requirements (previous devices had up to 10 electrodes).
- Waters Corp. operates a commercialized thin SID device in the SELECT SERIES Cyclic IMS with the surface and extractor at the same voltage, *which possibly influences ion transmission efficiency*.[4]
- **Thus, we are investigating the effect of tuning the extractor relative to the surface voltage to determine the effect on ion transmission and observed SID product ions.**

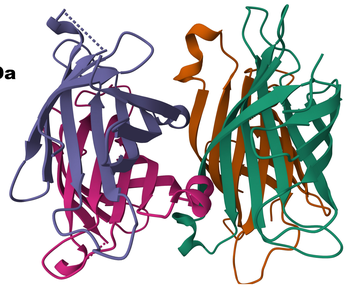
Instrumentation and Methods

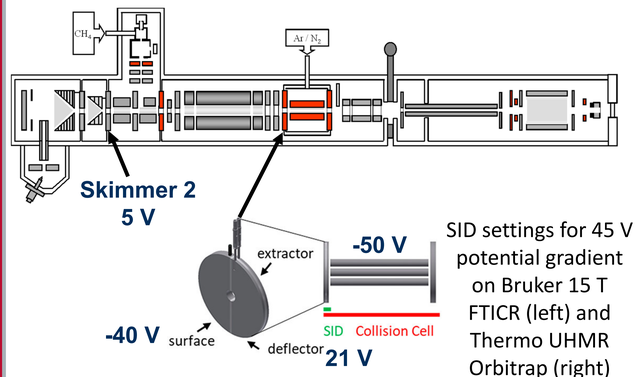
- Bruker solariX XR 15 T FTICR with 3 mm long SID device, replacing the RF collision cell's entrance lens.
- Thermo Scientific Q Exactive Ultra-High Mass Range (UHMR) Orbitrap mass spectrometer with 3 mm long SID device, which replaces the end cap electrode of an e-MSion ExD device, allowing post-ECD and post-ECnoD SID.

Apo-Streptavidin 53 kDa

(PDB: 1SWB)

Tetramer via dimer of dimers topology





SID settings for 45 V potential gradient on Bruker 15 T FTICR (left) and Thermo UHMR Orbitrap (right)

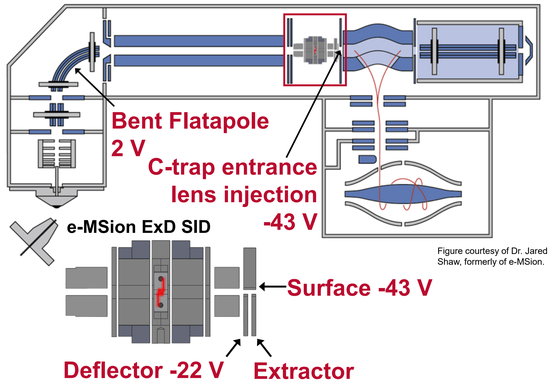
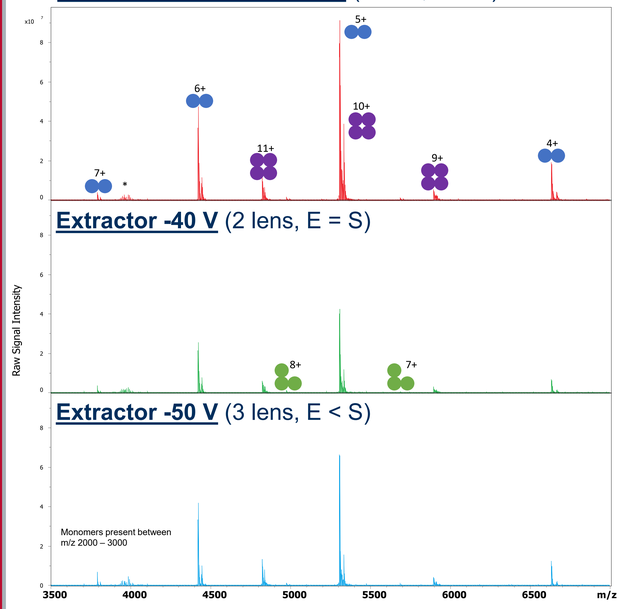


Figure courtesy of Dr. Jared Shaw, formerly of e-MSion.

FTICR with Extractor -32 V (3 lens, E > S)

Extractor -40 V (2 lens, E = S)

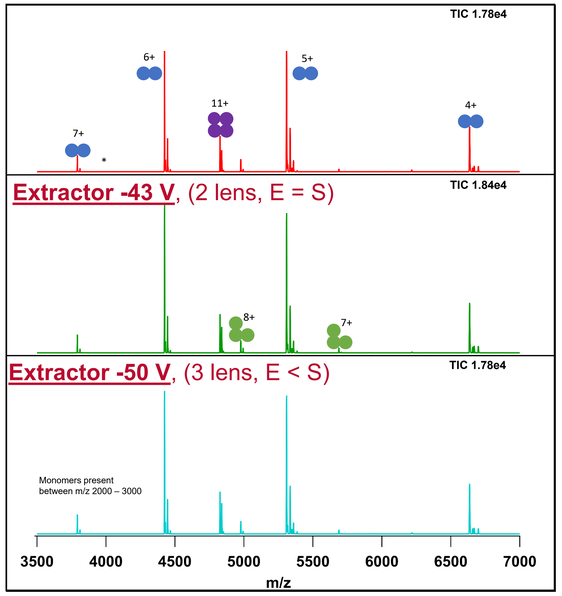
Extractor -50 V (3 lens, E < S)



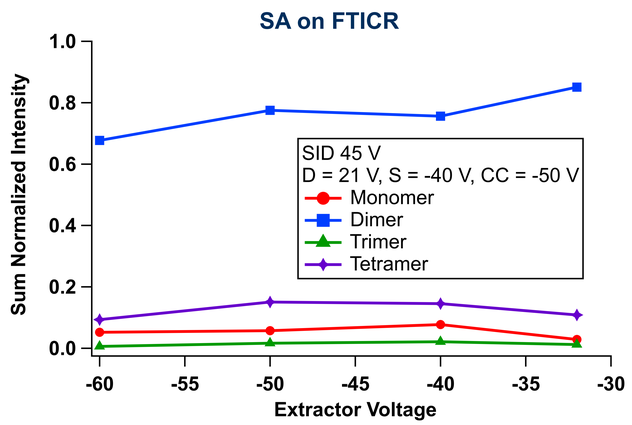
UHMR with Extractor -40 V, (3 lens, E > S)

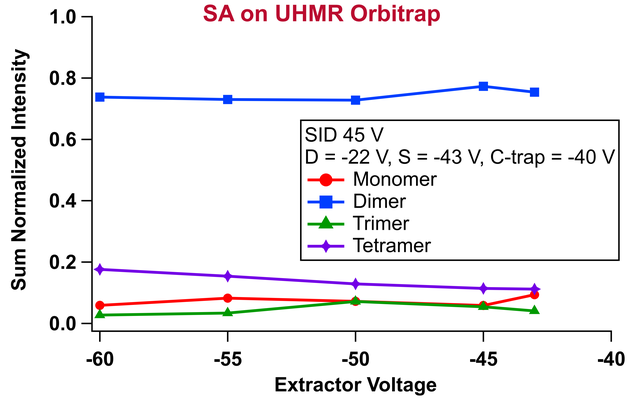
Extractor -43 V, (2 lens, E = S)

Extractor -50 V, (3 lens, E < S)



Tuning the extractor higher than, equal to, and lower than the surface voltage had minimal effect on observed spectra and signal intensity.





References

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(4) Snyder, D. T.; Jones, B. J.; Lin, Y.-F.; Cooper-Shepherd, D. A.; Hewitt, D.; Wildgoose, J.; Brown, J. M.; Langridge, J. I.; Wysocki, V. H., Surface-induced dissociation of protein complexes on a cyclic ion mobility spectrometer. *Analyst* **2021,** *146* (22), 6861-6873.

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