



Investigation of Ion-Surface Collisions

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Motivation



5-30 % of the translational energy of an ion is transferred to internal energy during surface collision.

The translational to internal energy transfer (T-V) depends on:

Mass and shape of the impacting molecule

Terminal group of the target surface

Motivation



Fragmentation pattern is characteristic for molecules and surfaces:

Known surface properties allow characterization of molecules

Known bond-dissociation thresholds of molecules allow characterization of surface samples

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Motivation



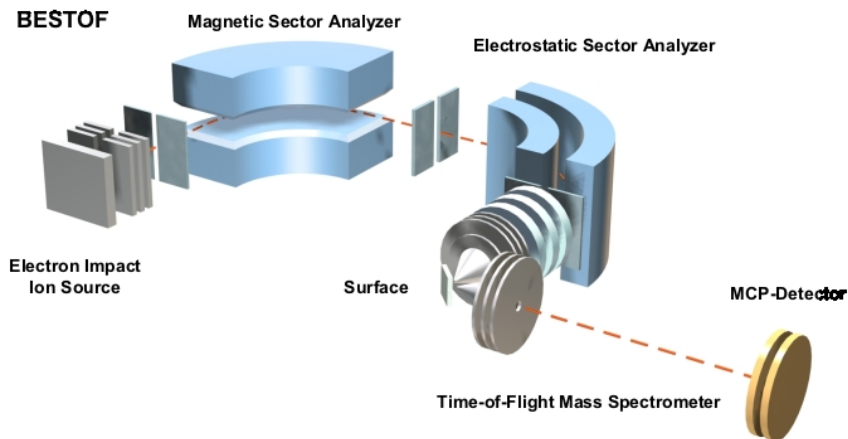
During ion-surface collision a narrower distribution of internal energy is deposited into the ion than for example in CID.

Access to high-energy fragmentation in a single collision.

Extraction of accurate activation energies possible.

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Experimental Setup



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Experimental Setup



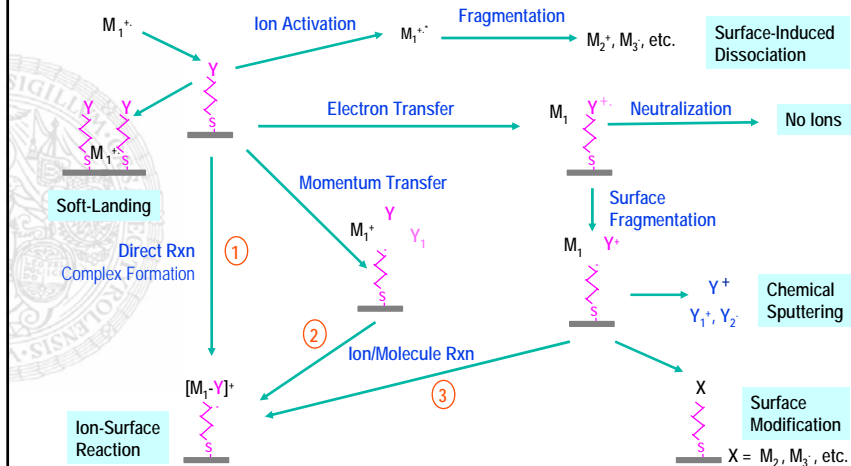
- Ion production by electron impact ionization with narrow translational energy distribution of < 1 eV
- Selection of projectile ion with double-focusing MS
- Collision with target surface at 45° incidence angle
- Collision energy range from almost 0 to 2000 eV
- Detection of fragment ions with TOF-MS

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Data Evaluation



Various processes can take place during collision:



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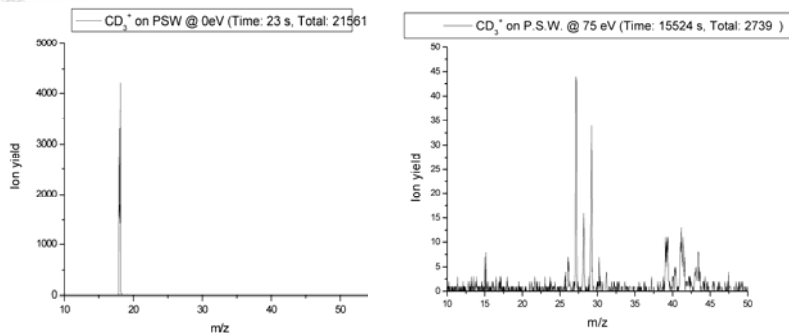
Data Evaluation



Identification of underlying processes at different energies:

Yields of secondary ion showing up in mass spectra

Thermochemical properties of the molecules involved



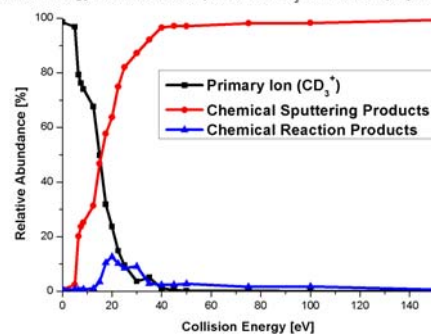
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Data Evaluation



Normalized fragment ion signal vs. translational energy of parent ion shows threshold values for fragment ion production

Collision Energy Resolved Mass Spectrum of CD_3^+ on Plasma Sprayed Tungsten



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Data Evaluation



Characterization of surfaces (T-V value,...) are as well possible as characterization of molecules (activation energies,...).

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Ongoing Projects-Collaborations



Max-Planck-Institut
für Plasmaphysik
EURATOM Assoziation

Werner Schustereder, Max-Planck Institut für Plasmaphysik, D:
Determination of sticking coefficient of small hydrocarbons on
fusion relevant materials in dependence on collision energy,
angle of the incident ion beam and temperature on the surface.
Recent measurements: CD_3^+ on plasma-sprayed tungsten

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Ongoing Projects-Collaborations



Herman Zdenek, Heyrovský Institute of Physical Chemistry,
Academy of Sciences, CZ:

Interaction of small hydrocarbon ions with fusion relevant
materials at various collision energies.

Comparison of 'clean' with hydrocarbon covered surfaces

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Ongoing Projects-Collaborations



Jan Skalny, Department of Plasma Physics Comenius University Mlynska dolina, SK:

Investigation of tungsten and beryllium coated surfaces in comparison to pure tungsten and beryllium surfaces.

Ongoing Measurements: CD_3^+ on tungsten covered stainless steel prepared by magnetron sputtering

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End



Thank you for your attention !

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