

Ion Scattering Spectroscopy

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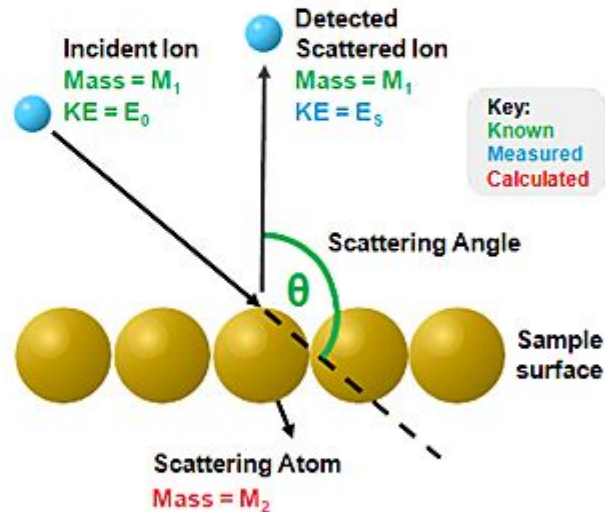
Group 33339/1

What is Ion Scattering Spectroscopy?

- **Ion scattering spectroscopy (ISS)**, is a surface-sensitive analytical technique used to characterize the chemical and structural makeup of materials.
- Ion scattering spectroscopy often refers to the use of low (LEIS) energy ions in the range of 0.5 to 10 keV.
- **Low-energy ion scattering spectroscopy (LEIS)**,

Technique

- Ions are directed onto a sample and the energy of the backscattered projectiles is determined.
- The ionized particles are single atoms usually in a single positive charge state.
- LEIS typically uses a scattering angle around 135°



Experimental geometry for ion scattering spectroscopy.

General experimental setup for LEIS.

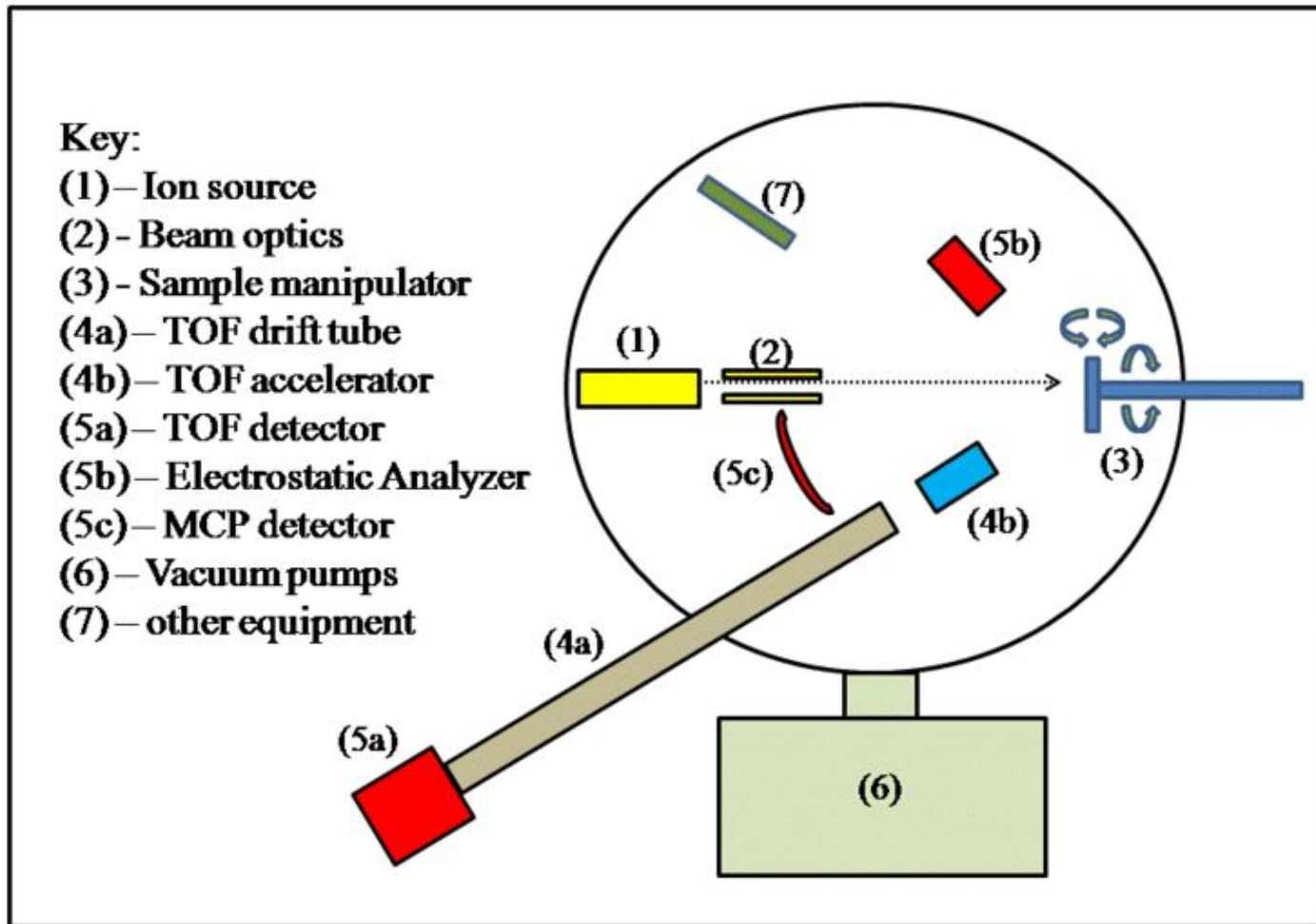
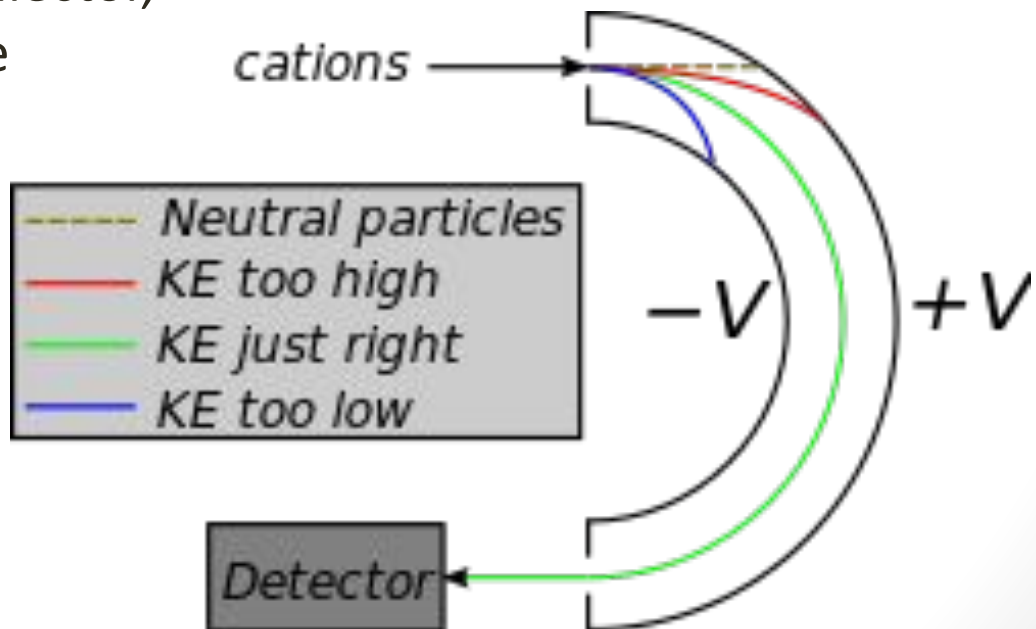
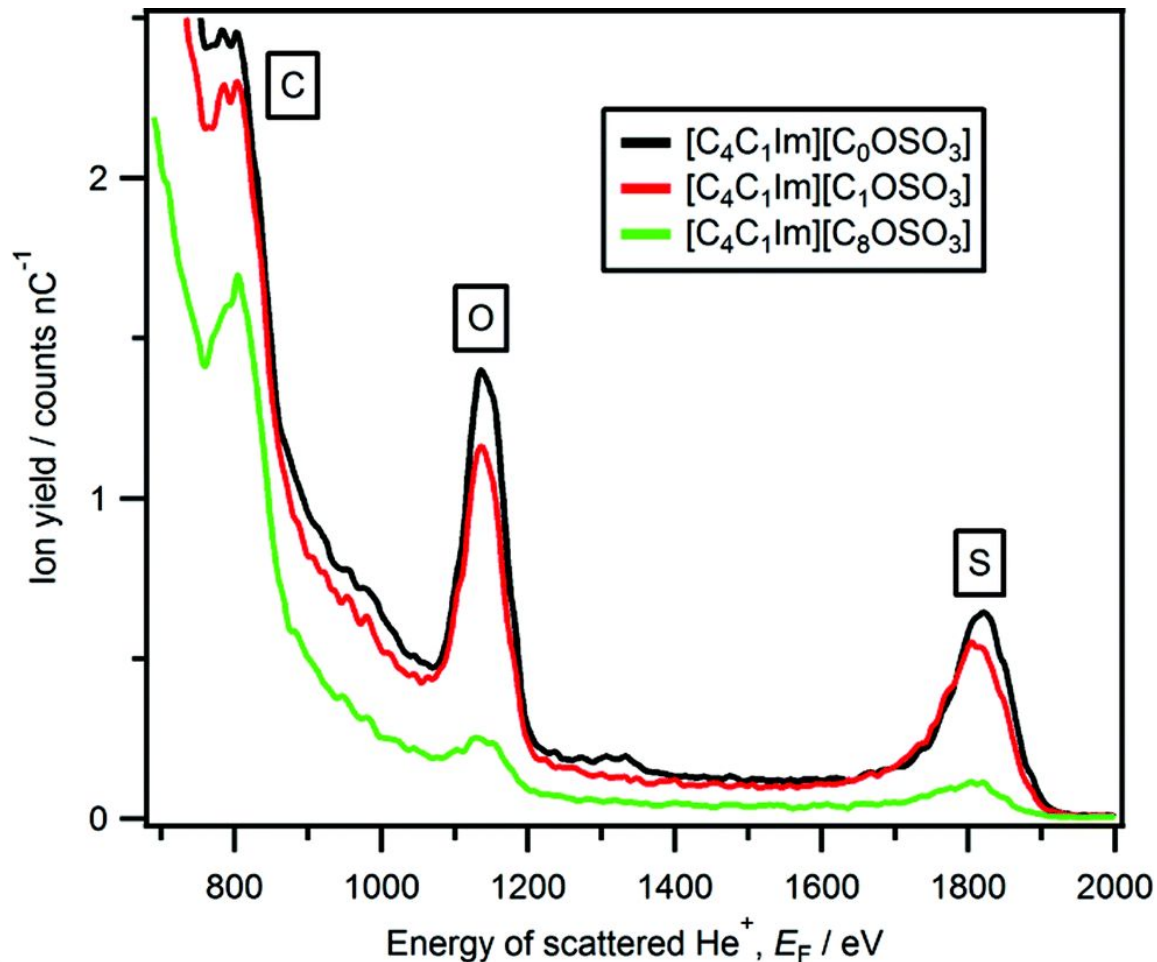


Diagram of an electrostatic analyzer in the hemispherical geometry

- Only ions of a selected energy pass through to the detector.
- Using electrostatic deflectors to direct only ions of a particular energy range into a collector, while all other ions are redirected.



Experimental geometry for ion scattering spectroscopy



Calculations

- The equation below shows how the energy of a scattered ion peak is related to the other relevant factors.
- E_s = Kinetic energy of the scattered ion
 M_1 = Relative atomic mass of the scattered ion
 E_0 = Kinetic energy of the primary ion beam
 M_2 = Relative atomic mass of the scattering surface atom
 θ = Scattering angle

$$\frac{E_s}{E_0} = \frac{\cos\theta \pm \left[\left(\frac{M_2}{M_1} \right)^2 - \sin^2\theta \right]^{1/2}}{1 + \left(\frac{M_2}{M_1} \right)}$$

Thanks for attention!