XRF Analysis
Overview, Pros and Cons

André Algazi
California Department of Toxic Substances Control
Safer Consumer Products Program
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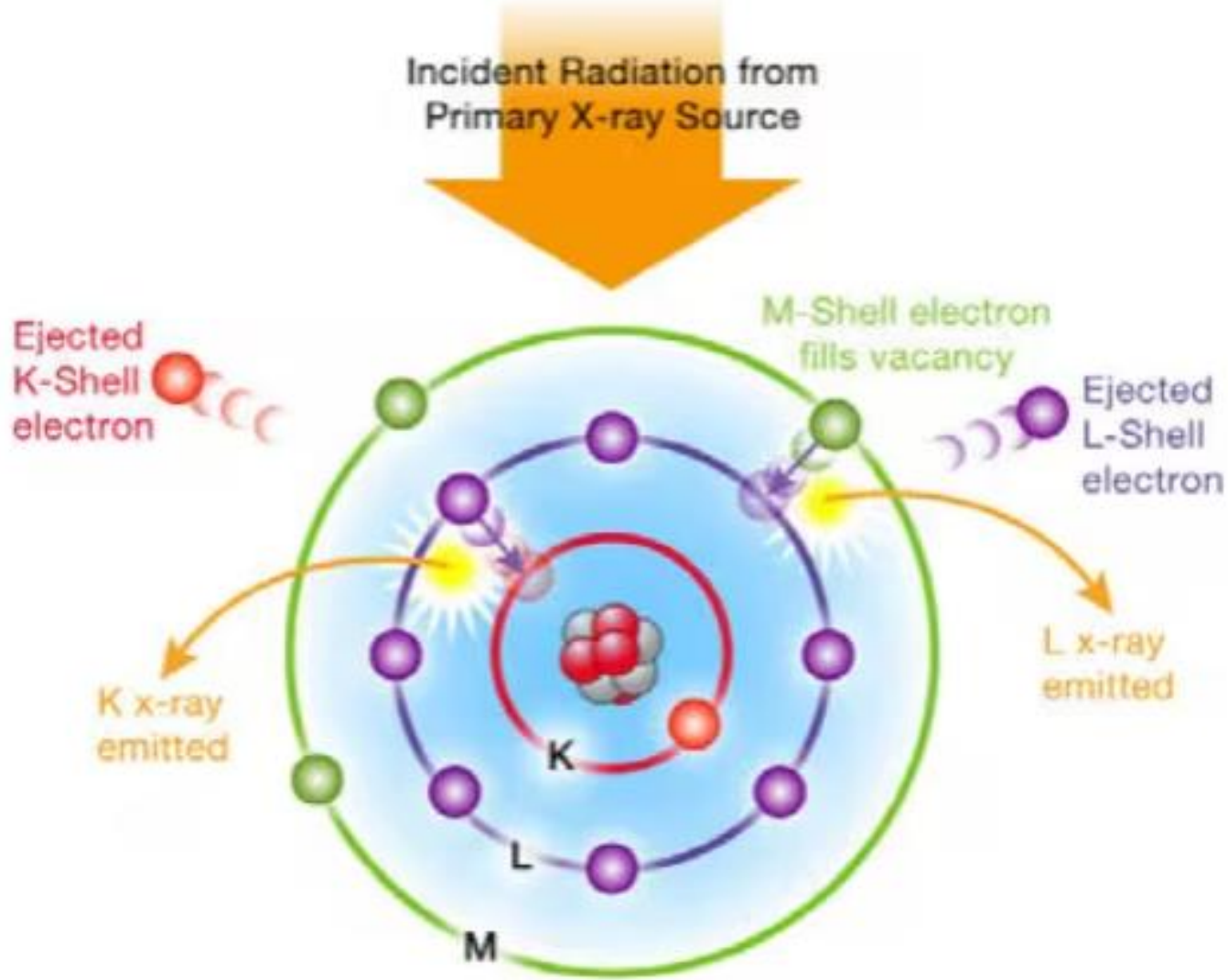
What is XRF

- A rapid, non-destructive analytical technique
- For qualitative and semi-quantitative analysis of samples
- Detects and measures elements in samples
- There are handheld/portable and benchtop XRF analyzers
  - Handheld: portable, cheaper, less sensitive, less accurate
  - Benchtop: not portable, costlier, more sensitive, more accurate

Principle

- High energy X-rays from the analyzer's x-ray tube strike atoms in the sample
- Electrons from an atom's inner orbital shells are dislodged
- Electrons from higher energy orbitals shells take the place of the dislodged ones
- Fluorescent x-rays with energy equal to the energy difference between orbital shells are emitted
- Characteristic patterns of emitted x-rays tell you what atoms are present



ThermoFisher Scientific https://www.thermofisher.com/blog/ask-a-scientist/what-is-xrf-x-ray-fluorescence-and-how-does-it-work/

Pros

- Nondestructive
- Fast
- Low cost per sample
- Can analyze a range of elements
- Others?

Cons

- Only analyzes the surface of a material (~1 mm)
- Can’t distinguish compounds
- Can’t differentiate oxidation states
- Handheld units not very sensitive (ppm levels)
- Lighter elements harder to detect
- Results are semi-quantitative
- Radiation safety considerations
- Others?

Discussion: how have you used XRF for product testing?

- For what purpose (screening, compliance testing, etc.)?
- What elements have you looked for?
- What sample matrices have you analyzed?
- Did the XRF data meet your data quality needs (for precision, accuracy, sensitivity, etc.)?
- What challenges did you encounter?