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Lab. 5: Nanomaterials characterization

Characterization refers to study of materials features such as its: Composition -

Structure – Physical – Electrical - Magnetic and etc.

• Nanomaterials properties vary significantly with **size** and **shape**.

• Characterization of s will depend on the type of nanomaterials and its intended purpose.

• Physiochemical characterization include (Non-imaging and Imaging)

Tools used in non-imaging physiochemical characterization of NPs

1. UV-Vis Spectrophotometer

- Allows identification, characterization, and analysis of metallic nanomaterials (e.g., silver, gold).

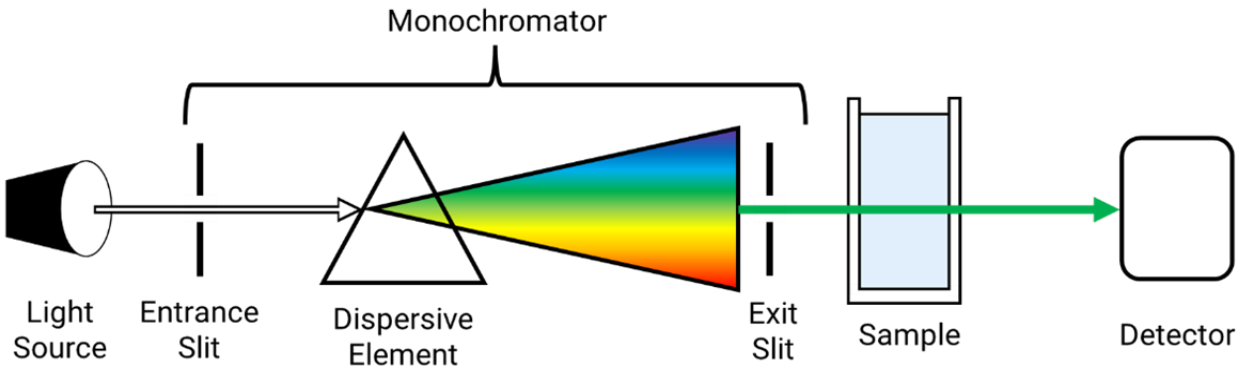
- It can be used to determine size and evaluate the dispersion and local structure of

- Nanomaterials synthesized with metal oxides, selenides (Se^{2-}), and sulfides.

- Nanomaterials (especially gold NPs) have very high extinction coefficients* when their diameter is > 10 nm, they have a very high absorbance.

*Extinction coefficient: refers to several different measures of the absorption of light in a medium.

- It is difficult to measure absorbance of highly concentrated samples using a cuvette with 1 cm path length.

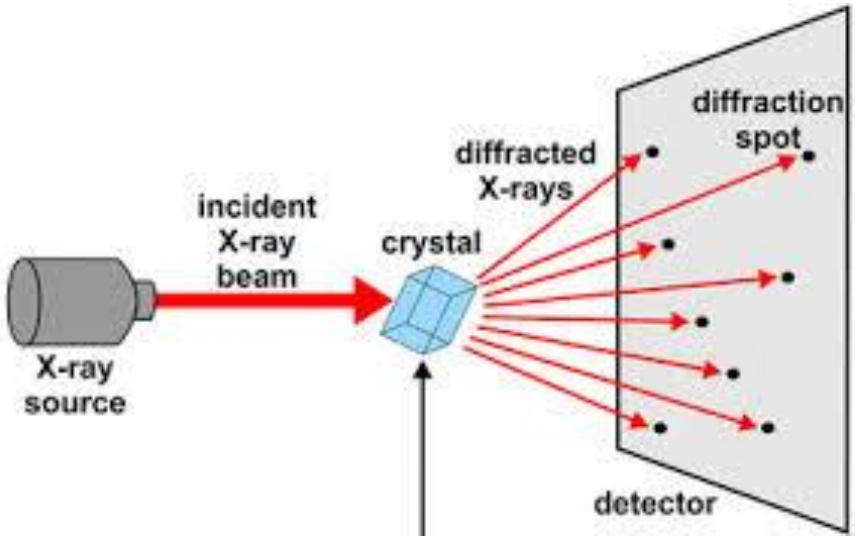


2. X-ray Diffraction (XRD)

Used to study the structural identification, composition and physical properties of materials

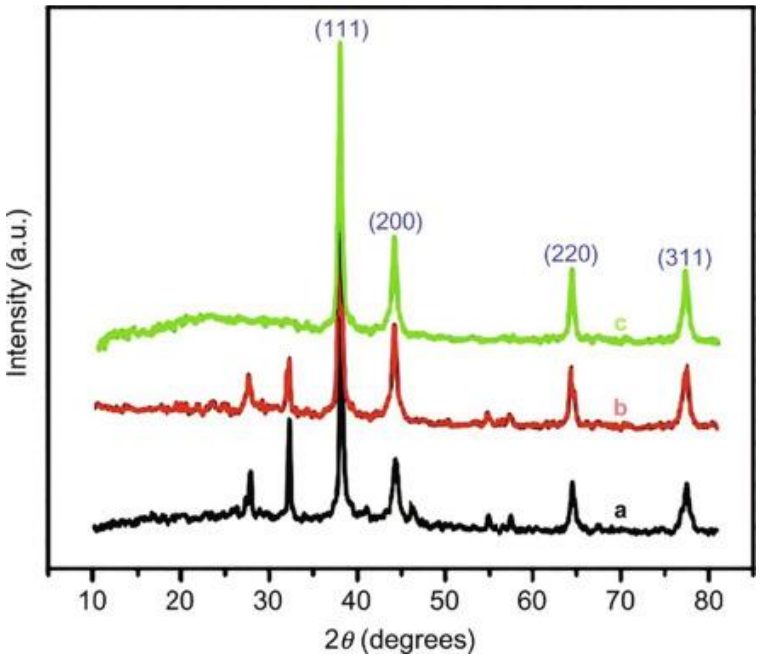
1. Amorphous: The atoms are arranged in a random pattern.

2. Crystalline: The atoms are arranged in a regular pattern.



- When X-rays interact with a crystalline substance (Phase), one gets a diffraction pattern.

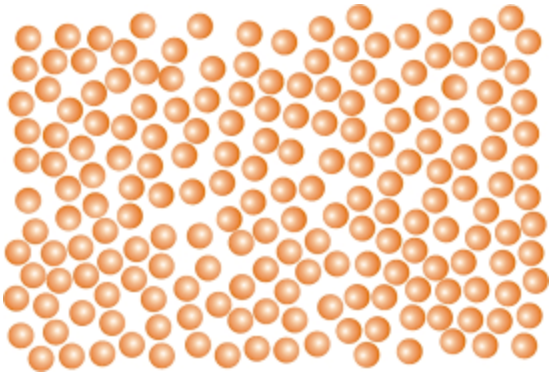
- The X-ray diffraction pattern of a pure substance like a fingerprint of the substance.



3. Dynamic light scattering (DLS)

Dynamic light scattering measures variation in scattered intensity with time at a fixed scattering angle (typically 90^{o}), while **Static light scattering** (SLS) measures scattered intensity as a function of angle.

- DLS is an important tool for characterizing the size of nanoparticles in solution.



Monodisperse (uniform) Polydisperse (polyform)

- DLS measures hydrodynamic size, size distribution, and polydispersity.

- DLS is a valuable tool for determining and measuring the agglomeration state of nanoparticles as a function of time or suspending solution.