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photography

Sample characterization using X-ray powder diffraction technique

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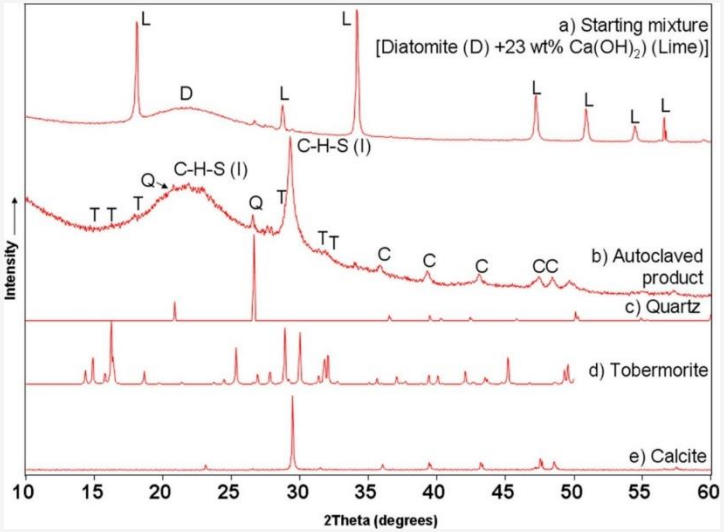

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Content:

- Why XRPD?
- How does it work?
- Interpretation…
- Questions?
- Thank you note

Why?

- X-ray powder diffraction is most widely used for the identification of unknown crystalline materials (e.g. minerals, inorganic compounds) in environmental science, material science, engineering, biology, etc.

Figure 1. Clayey diatomite, pure diatomite and non-expanding perlite, fly-ash, bentonite clay, magnesite

How?

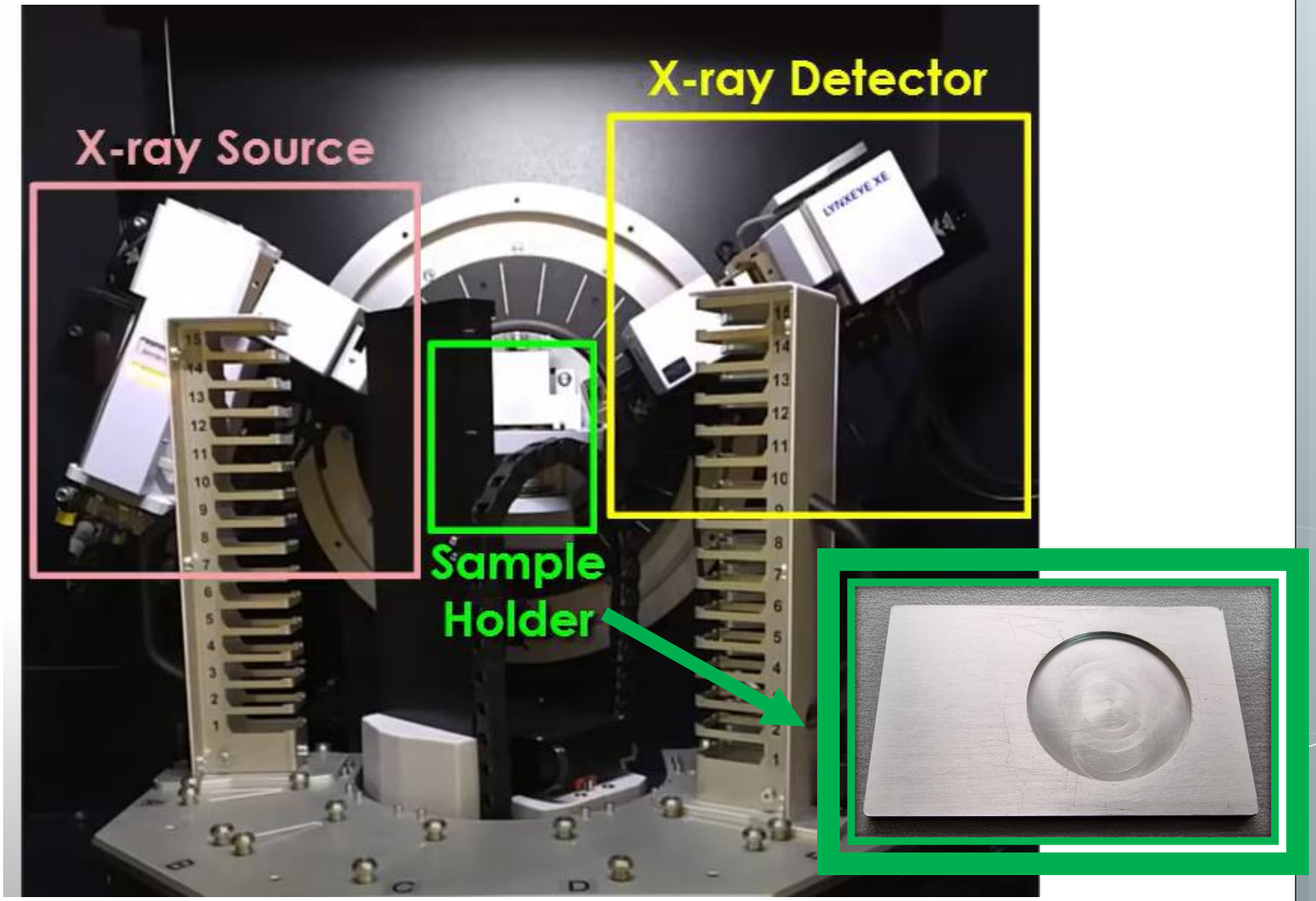


Figure 2. XRPD diffractometer

How?

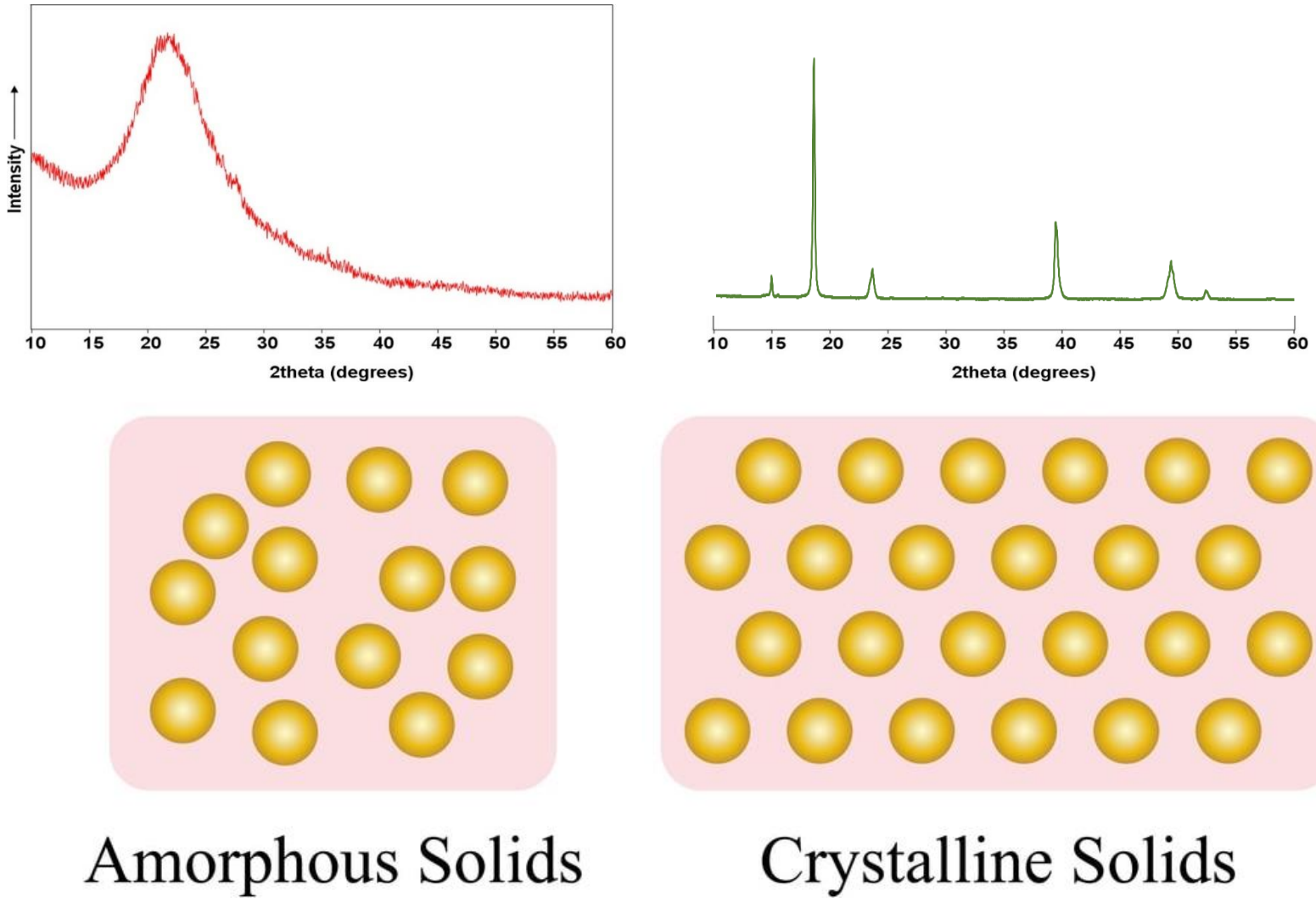


Figure 3. Amorphous vs crystalline (constructive interference)

Strengths

- Powerful and rapid (< 20 min) technique for identification
- Minimal sample preparation is required
- XRD units are widely available
- Data interpretation is relatively straight forward
- Non-destructive technique

Limitations

- Sometimes it requires tenths of a grams of material which must be ground into a powder
- For mixed materials, detection limit is ~ 2-5% of sample
- Must have access to a standard reference file of inorganic compounds (d-spacings)

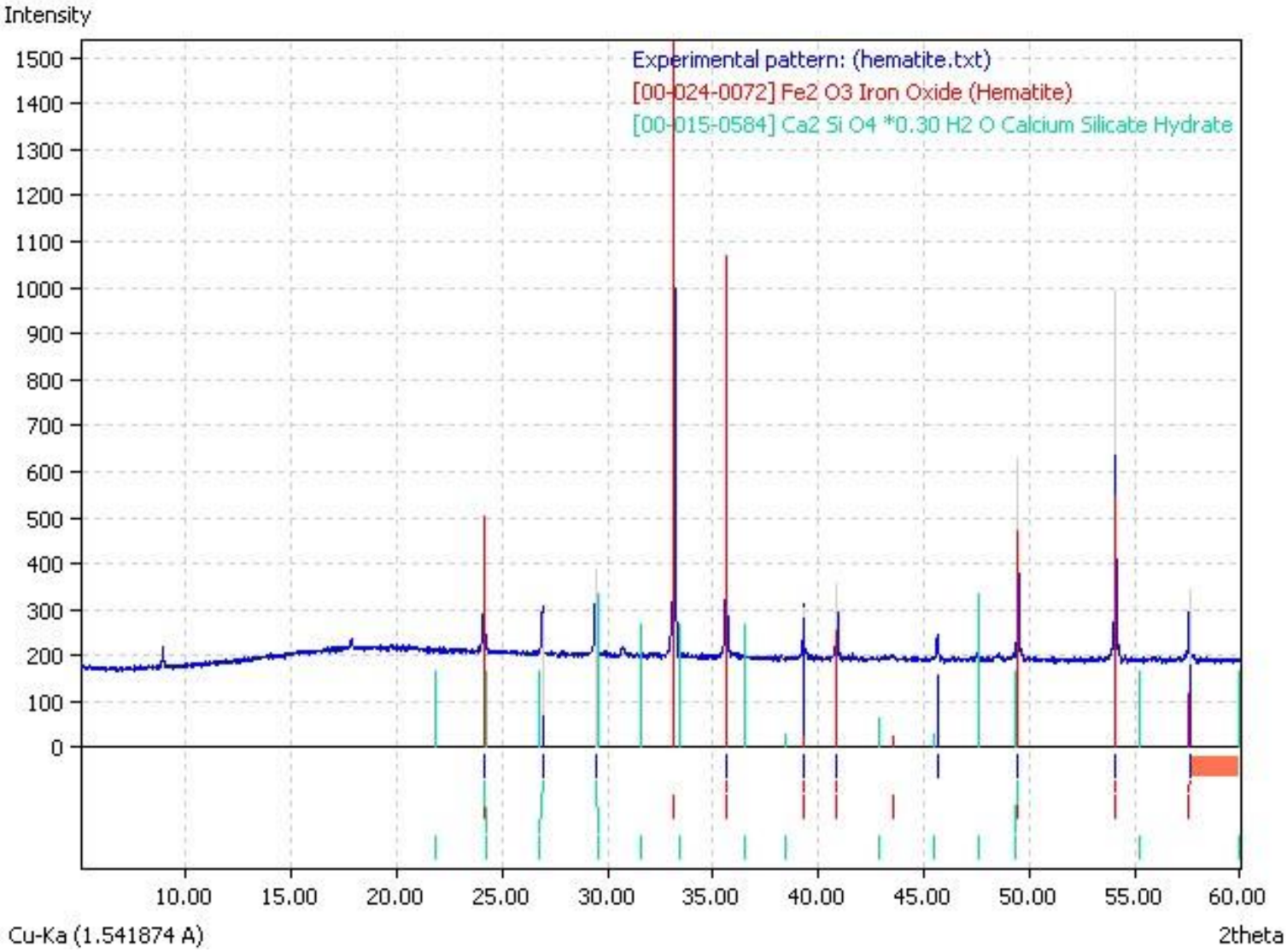
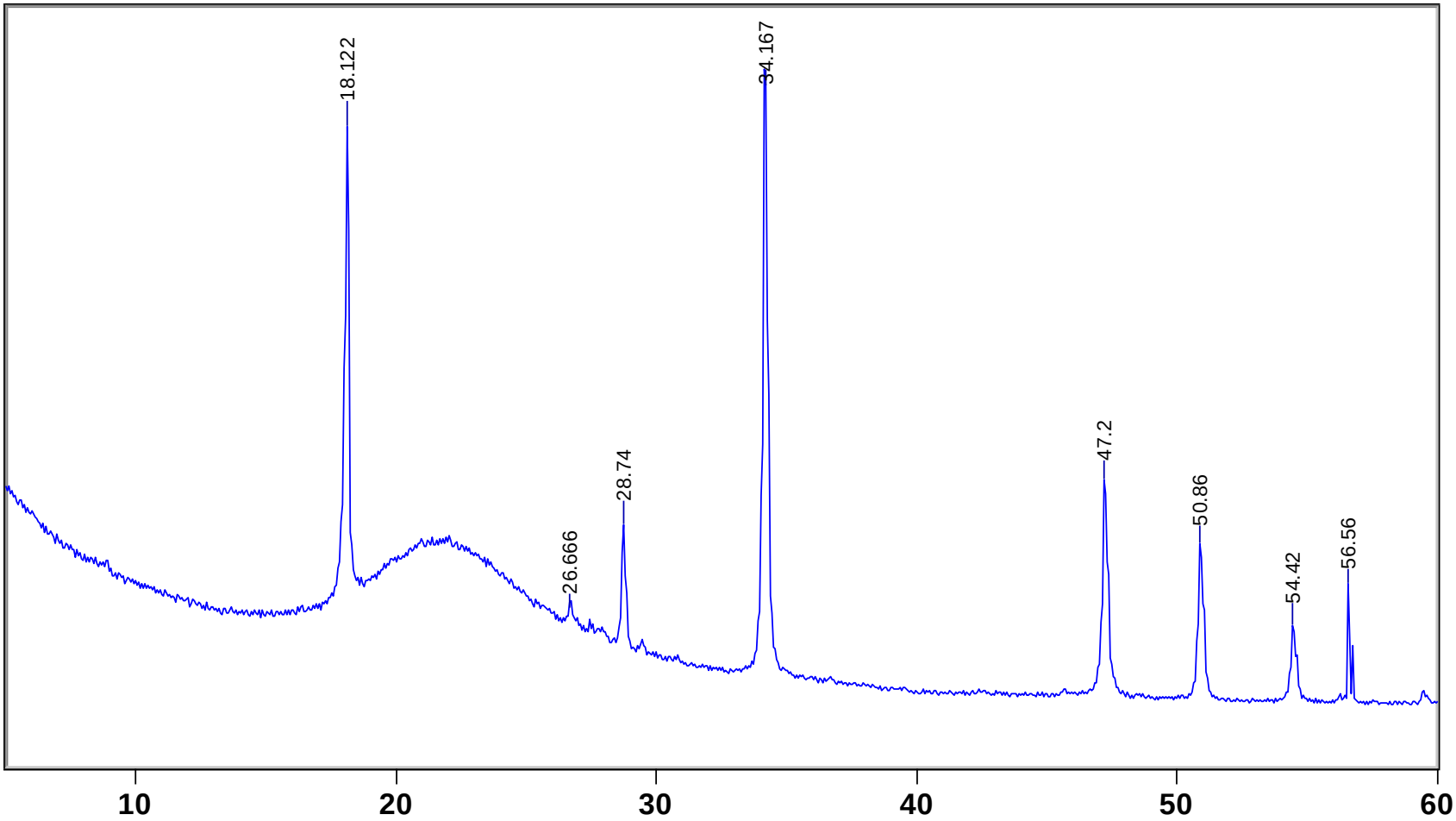


Figure 4. Sample of hematite ore


18.122
26.666
28.74
34.167
47.2
50.86
54.42
56.56
10
20
30
40
50
60

https://handbookofmineralogy.org/

http://webmineral.com/

https://rruff.info/

Portlandite $Ca(OH)_2$

X-ray Powder Pattern: Synthetic.
2.628 (100), 4.90 (74), 1.927 (42), 1.796 (36), 3.112 (23), 1.687 (21), 1.484 (13)

Quartz SiO_2

X-ray Powder Pattern: Synthetic.
3.342 (100), 4.257 (22), 1.8179 (14), 1.5418 (9), 2.457 (8), 2.282 (8), 1.3718 (8)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THANK YOU!

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