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MEASUREMENT REPORT

# INLINE SCANNING OF MINERALS IN MID-INFRARED

High-Speed Spectral Analysis of Minerals Using Mid-Infrared Spectroscopy

nlir
MEMBER OF THE NYNOMIC GROUP

IN COLLABORATION WITH HySpex by neo

# Mid-Infrared Reflectance Analysis for Minerals

The mid-infrared 2.0 – 5.0 µm region offers a valuable enhancement to established VNIR–SWIR core-scanning workflows by adding a deeper layer of mineralogical insight. While SWIR remains the cornerstone for rapid identification of OH-bearing minerals and alteration patterns, the 2.0 – 5.0 µm MIR window contributes complementary information by capturing combination and overtone bands that are highly sensitive to mineral structure, bonding environments, and subtle compositional variations. These mid-infrared analysis by NLIR were performed in collaboration with and in complement to the VNIR and SWIR imaging insights from HySpex.

These MIR features strengthen interpretations of carbonates, sulphates, phosphates, and complex silicates, and can highlight variations in crystallinity and cation substitution that are not always evident in shorter wavelengths.

When integrated alongside VNIR–SWIR imaging by HySpex, the 2.0 – 5.0 µm region acts as a powerful extension that:

- enriches mineral discrimination,
- improves confidence in mixed-lithology settings,
- elevates the overall diagnostic capability of core-scanning programs.

## MEASUREMENT SAMPLES

In this report, we have performed  mid-infrared reflectance analysis of six minerals measured with NLIR's REFLECTION Measurement System. The samples include:

- **Apatite** (calcium phosphate)
- **Muscovite** (potassium aluminium silicate)
- **Talc** (magnesium silicate)
- **Tourmaline** (complex boron aluminium silicate)
- **Baryte** (barium sulphate)
- **Calcite** (calcium carbonate)

Apatite sample

Calcite sample

Talc sample

Tourmaline sample

Baryte sample

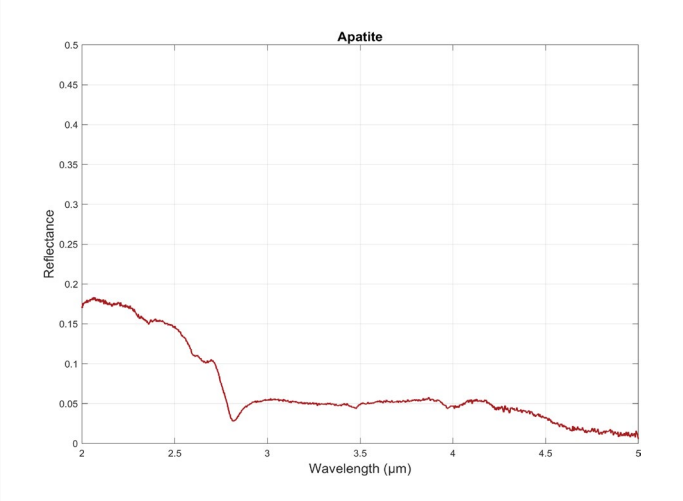
# Spectral Data Obtained and Key Observations

## MEASUREMENT SET-UP

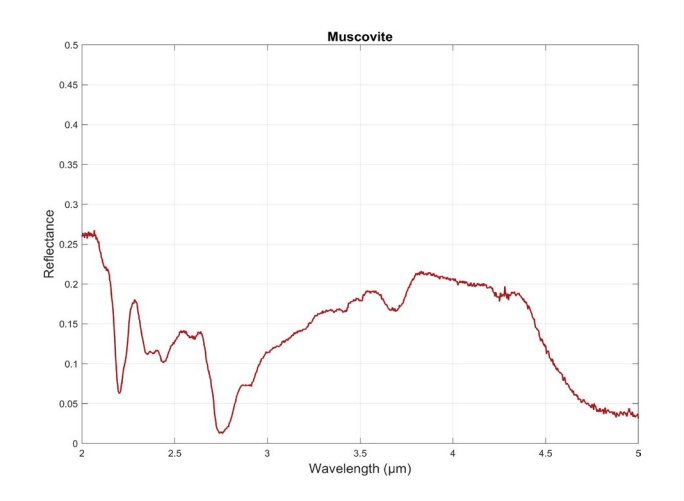
We have performed high-speed mid-infrared reflection spectroscopy on 6 different minerals using NLIR's REFLECTION Measurement System consisting of MIDWAVE Spectrometer, AURALIS Light Source and the SAMPLER Accessory. The exposure time used for each spot measurement was 30ms with 10 averages per measurement.

## KEY OBSERVATIONS

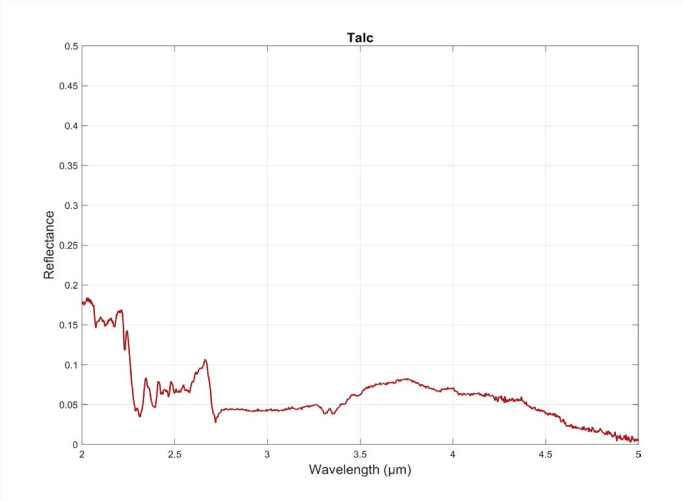
Analysis of the mid-infrared overtone and combination-band region (2.0 – 5.0 µm) provides several clear diagnostic signatures across the six minerals included in this study.
OH-bearing minerals—apatite, muscovite, talc, and tourmaline (see measurement samples' spectra below, respectively)—display strong absorptions in the 2.7 – 3.1 µm range. These bands are sensitive to bonding environment and cation coordination, and their shapes and positions help distinguish between dioctahedral (e.g., muscovite) and trioctahedral (e.g., talc) phyllosilicates, as well as revealing compositional variability within tourmaline.



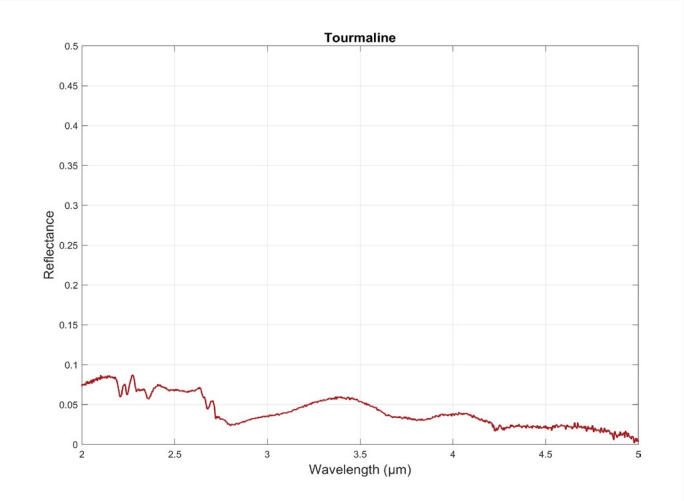

Sample 1. Reflectance measurement of Apatite.




Sample 2. Reflectance measurement of Muscovite.



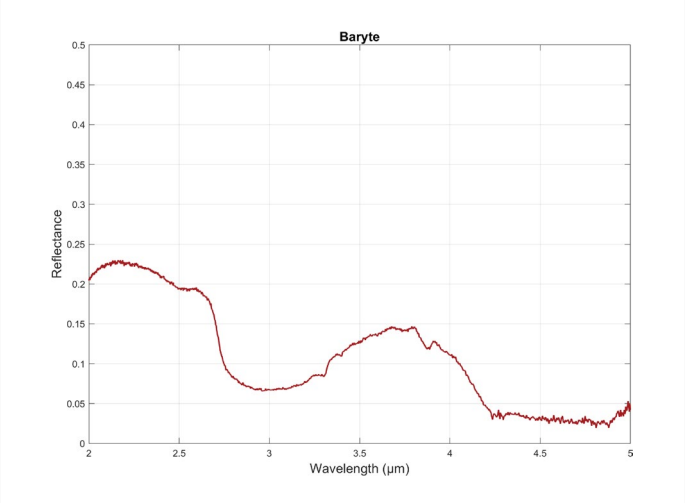

Sample 3. Reflectance measurement of Talc.



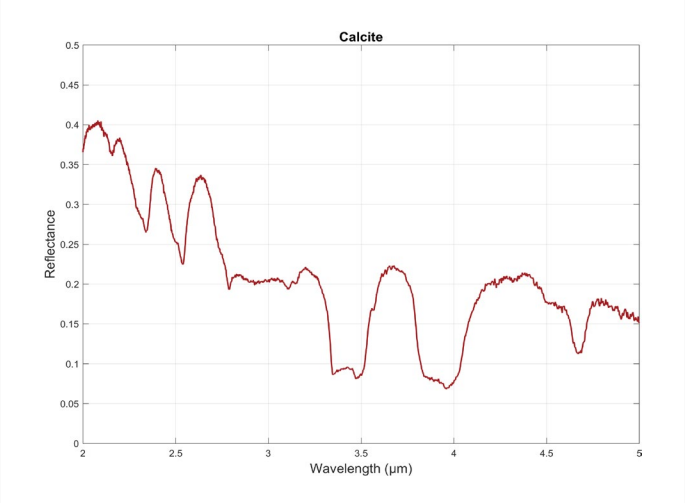

Sample 4. Reflectance measurement of Tourmaline.

# Spectral Data Obtained and Key Observations, cont.

Non-hydrous phases show complementary patterns. Calcite (see sample's spectrum below) exhibits broad carbonate combination bands centred around ~3.4 µm with additional features toward 4.6 µm, while baryte (see sample's spectrum below) presents distinct sulfate signatures between ~3.9 – 4.3 µm. Apatite combines phosphate-related overtone features with an OH band near 3 µm, supporting identification of hydroxyl-rich apatite.




Sample 5. Reflectance measurement of Baryte.




Sample 6. Reflectance measurement of Calcite.

Together, these observations demonstrate that the 2.0 – 5.0 µm MIR region provides sensitive and highly complementary mineralogical information. Using NLIR's mid-infrared REFLECTION Measurement System, you can perform absorption spectroscopy that:

- enhances discrimination of carbonates, sulfates, phosphates, and silicates;
- supports general interpretation of hydration state and structural order;
- offers rapid classification capabilities well suited for integration into core-logging workflows alongside VNIR–SWIR and full MIR measurements.

## BRING MINERAL ANALYSIS TO THE PRODUCTION LINE

NLIR's mid-infrared spectrometers are significantly faster than traditional FTIR instruments and can measure absorption spectra features of minerals in just a few milliseconds. This enables real-time inspection in-line. Key advantages of NLIR's spectrometers include:

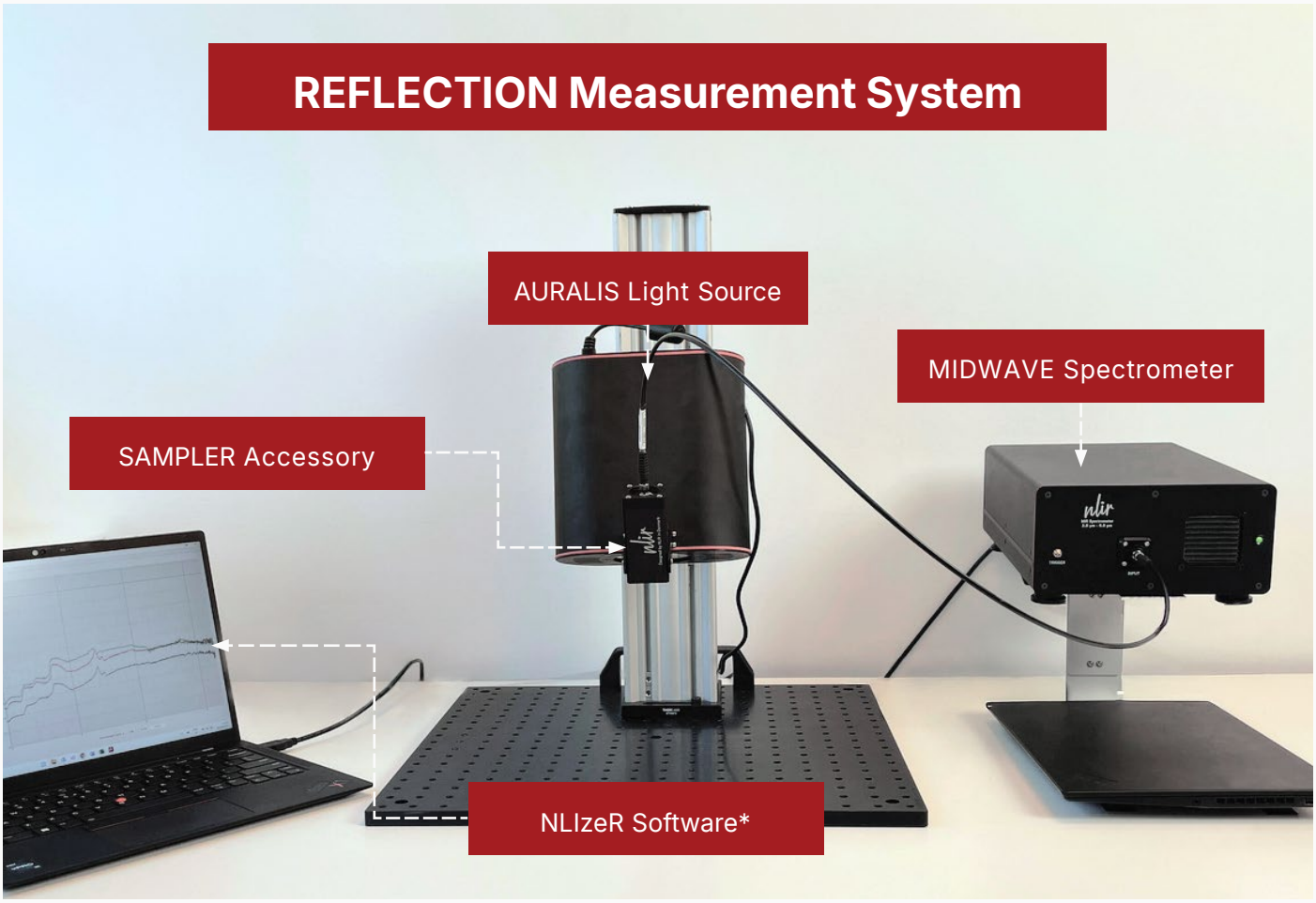
### Live Data
Full-spectrum acquisition at up to 400 Hz enables real-time insights

### Sharper Insights
2000 pixels across 2.0 - 5.0 µm ensures precise features

### High-Throughput
Being portable and robust, our devices can be integrated to scan large surfaces

### Excellent Service
Professional advice and lifetime support will ensure uninterrupted workflow

# Setup for Reflection Measurements Using NLIR's Equipment




*Included with MIDWAVE Spectrometer

## Would you like to gain deeper insights into minerals at scale?

If you are looking to gain faster and more accurate characterization of key mineral groups and subtle variations in alteration, NLIR's MIR spectroscopy solutions can provide you insights beyond traditional methods. Offering high-speed acquisition for large-area coverage of the mineral ores, NLIR can help you gain deeper mineral insight without slowing production or throughput.

**Contact us: info@nlir.com +45 7174 7870**