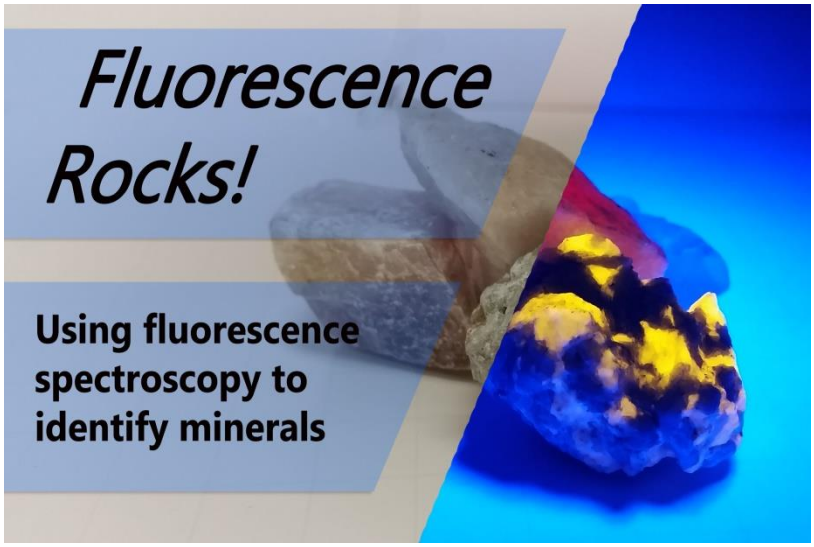
Application Note- Fluorescence Spectroscopy of Rocks and Minerals

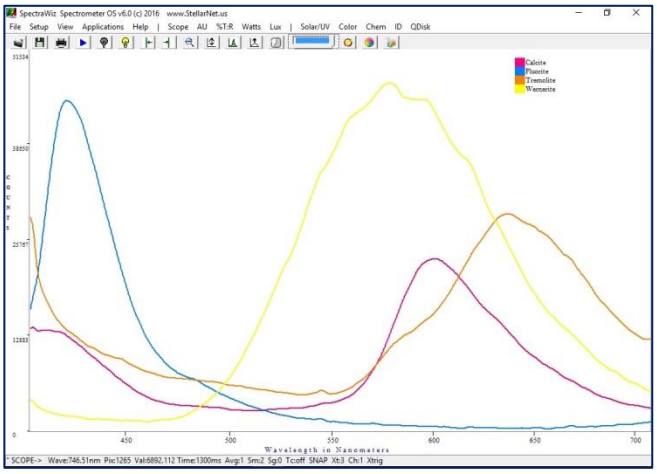
What is Fluorescence Spectroscopy and Why is it Important?



Light interacts with matter in a few basic ways: reflectance, transmission, and absorption. In some cases when light is absorbed it will be re-emitted as light at a longer wavelength. The most obvious example of this is ultra-violet fluorescence. The sample absorbs UV light (invisible to the human eye) and emits light in the visible region. This causes the sample to have a unique color only when observed under UV light. Measuring this reaction using spectroscopy gives insight into a sample's composition.

Fluorescence spectroscopy is commonly used across the sciences for a variety of purposes. This technique enables researchers to quantify or identify materials using low cost and portable instruments called fluorimeters. This method is also non-destructive and does not require extensive sample preparation. The benefits of fluorescence spectroscopy make it ideal for biological, chemical, and environmental applications.

Fluorescence spectroscopy is vital to geology, gemology, and mineralogy. It can be used to characterize fluorescent minerals in the field and authenticate different materials. For example: natural rubies, emeralds and diamonds fluoresce in the red region when long wave UV light is absorbed. This method can be implemented to rapidly identify counterfeit gems.



Fluorescence Spectra of Fluorite (blue), Wernerite (yellow), Calcite (pink), & Tremolite (orange) using a StellarNet preconfigured Fluorescence System

The type of fluorescence of a sample can also indicate its makeup and detect impurities. Sphalerite is a mineral made up of many elements. The ratio of the common elements like magnesium,

Zinc, and others determine whether its fluorescence is a pale yellow, or a bright orange. Using a calibrated fluorimeter is an easy analytical method for accurately determining sample composition.

Here are some examples of fluorescent minerals and their fluorescent emission colors when excited by long and short wave UV light:

Fluorescent Minerals		
Mineral	Short Wave	Long Wave
Hackmanite	Pink	Orange
Wernerite	Dark Yellow	Dark Yellow
Opalite	Light Green	Light Yellow
IcelandSpar (Calcite)	White – Pink phosphorescent	Cream –Pink
Chalcedony	Bright Green	Yellow- Green
Albite	Dull red	Dull pink
Sheelite in Tungsten ore	White	---
Willemite	Orange-red	---
Tremolite	Orange	Pink
Fluorite	---	Blue-Purple
Turritella Agate	Cream-Yello	Cream-Yellow
Fossil Algae	Cream-Orange	Cream-Yellow
Scapolite	Deep red	---
Calcite	White- Pink Phosphorescent	Cream-Pink
Resinous Coal	Yellow-White	Yellow-White

Compact spectrometer systems preconfigured for fluorescence may consist of an LED excitation source with various UV wavelengths, a fluorescence probe, and a high sensitivity TE cooled compact spectrometer such as the BLACK-Comet-TEC or SILVER-Nova models. These spectrometers are designed to analyze a wide range of fluorescent signals from the UV into the NIR. Samples with weak fluorescent response are easily detectable with the instrument's high sensitivity and large dynamic range.

Contact one of our applications scientists to learn more
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