

Hyperspectral imaging sensors provide unique benefits to increasing the production capacity and efficiency of key operational areas within the mining and mineral processing industries.

The utilization of hyperspectral imaging for in-line inspection of raw minerals and materials-in-process holds notable benefits for increasing the quantity and quality of finished product and also offers a significant financial return on investment for production facilities by increasing the throughput and yield within processing centers – all with safe, non-invasive imaging instruments that are cost-effectively deployed at key steps throughout the production process.

When Hyperspec® imaging sensors are deployed early on in the production process, raw material can be analyzed in-line for mineral content to determine the blending additives necessary required for the final product. When optimized for in-line conveyor processing, the Hyperspec® instruments are fully-capable of processing at very high speeds based on spectral regions and wavelengths of interest.

For high throughput processing, wavelength-specific criteria for high speed quality control and analysis can be readily deployed in an in-line manner along the production process line starting with raw material blending to in-process characterization and raw mill/clinker optimization. This capability yields mineral processors the benefits of reducing time, temperature, and duration of kiln processing while providing greater quality control over the composition of the final product.

For mineral mapping and quarry research, Headwall offers configurations tripod-mounted, point & stare configurations or pan & tilt sensors. Headwall also has written a 12-page Application Note along with contributions from ASD, Inc...a leader in hand-held spectrometers. The paper, titled *Airborne Hyperspectral and Ground-Truth Technologies*, is available upon request from www.headwallphotonics.com. Fully integrated Micro-Hyperspec®, Nano-Hyperspec® and High-Efficiency Hyperspec® configurations are also available for airborne deployment.



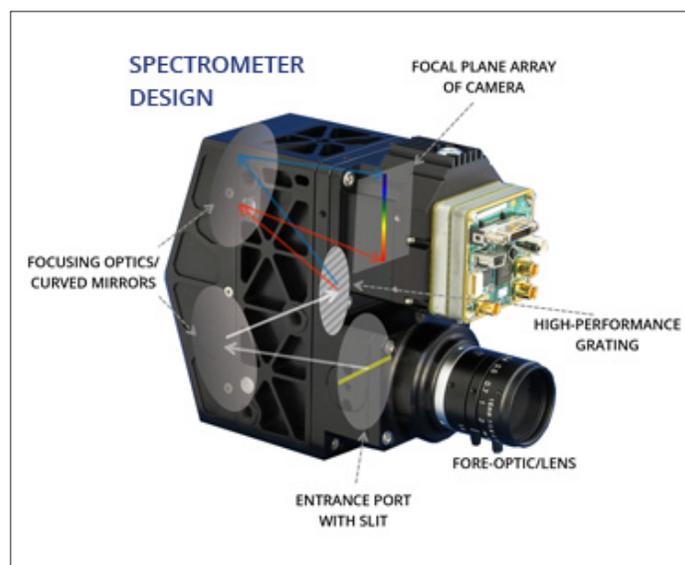
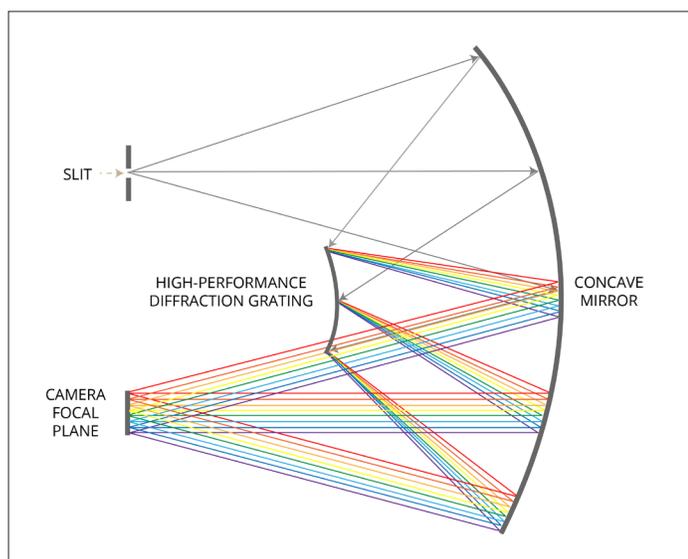
- Airborne Mineral Mapping
- Cement Production
- Drill Core Analysis
- Environmental Impact Assessment
- High Throughput Mining
- Quarry Analysis
- Raw Material Blending & Optimization

Headwall is the world's leading manufacturer of hyperspectral imagers (Hyperspec®) for a wide range of industries including remote sensing, advanced machine vision, precision agriculture, and others. The Company also manufactures OEM spectrographs and spectral engines that are exceptionally precise with respect to high spectral and spatial resolution and signal throughput.

The core technology fundamental to these products is the holographic diffraction grating, which Headwall manufactures to exacting dimensions and tolerances and to customer specification. This allows for small and rugged

optical imaging instruments that deliver aberration-corrected performance and a very wide field-of-view. Used in Headwall's *concentric-style* imagers along with mirrors, the designs are simple yet elegant and feature no moving parts.

In addition to hyperspectral, Headwall also manufactures Raman imaging instruments that are available in a wide range of laser excitation wavelengths. Raman Explorer and Raman Discovery are very well suited for chemical imaging applications as well as biotechnology and medical applications.



About Headwall Photonics: Headwall is the leading designer and manufacturer of imaging spectrometers and spectral instrumentation for industrial, commercial, and government markets. Headwall's high performance spectrometers, spectral engines, and holographic diffraction gratings have been selected by OEM and end-user customers around the world for use in critical application environments. As a pioneer in advanced, patented optics technology, Headwall enjoys a market-leading position through the design and manufacture of spectral instrumentation that is customized for application-specific performance.

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