UMSL Innovations
University of Missouri–St. Louis

Improved Sensitivity of Analytical Instruments

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TECHNOLOGY 1: EXTERNAL AND INTERNAL OPTICAL ADAPTERS FOR FTIR

Spectroscopy measurements require high sensitivity, precision, and accuracy, vital for chemical and biological analysis, product testing, and environmental monitoring. Enhanced sensitivity reduces noise in FTIR spectrometers by 50- to 100-fold, improving the signal-to-noise ratio. This patented technology employs a movable beam splitter, variable bandpass filter, preamplifier, and photodiodes to enhance signal quality. It can be used externally, internally in new FTIRs, or retrofitted into existing instruments.

- U.S. Patent No. 8,830,474 “External/Internal Optical Adapter with Biased Photodiodes for FTIR Spectrophotometer”
- U.S. Patent No. 8,766,191 “External/Internal Optical Adapter for FTIR Spectrophotometer"

TECHNOLOGY 2: NOISE CANCELLATION IN FTIR

To boost the signal-to-noise ratio in optical spectra captured by spectrophotometers, an interferometer induces interference effects into a light beam. In a dual beam setup, the source beam with interference is divided into a reference beam and a sample beam. The reference beam interacts with a reference substance and is sensed by a reference detector, while the sample beam interacts with the sample substance and is sensed by a sample detector. The optical spectra of the sample are derived from the disparity between the detected reference and sample beams.

- **U.S. Patent No. 7,903,252 “Noise Cancellation in Fourier Transform Spectrophotometry"**

TECHNOLOGY 3: MULTICHANNEL ULTRA-SENSITIVE OPTICAL SPECTROSCOPIC DETECTION

To enhance the sensitivity of spectrometers, noise in independent voltage signals is minimized using a reference wavelength from a region where sample optical absorption is minimal. Various embodiments employ a grating, filters, or both to select the reference wavelength. The differential voltage analyzer reduces noise by minimizing the difference between independent voltage signals and the reference voltage, achieved by adjusting a cancellation coefficient.

- **U.S. Patent No. 10,451,479 “Multichannel Ultra-Sensitive Optical Spectroscopic Detection"**

TECHNOLOGY 4: ULTRA-SENSITIVE SPECTROPHOTOMETER

The invention improves spectrophotometer devices for highly sensitive measurements by reducing light source noise. It features sealed housings without internal light sources and uses thermally conductive materials. Other aspects include reflection-based sample and reference cells, prisms with interaction surfaces, detectors, lenses, and closed interaction volumes. It identifies and minimizes noise-contributing components.

- **U.S. Patent No. 7,262,844 “Ultra-Sensitive Spectrophotometer"**

TECHNOLOGY 5: FOCUSED DROPLET NEBULIZER FOR EVAPORATIVE LIGHT SCATTERING DETECTOR

The invention introduces a focused droplet nebulizer generating uniform droplets of a specific size. These droplets are propelled through a small outlet by a contracting chamber and can travel along a non-divergent path in a drift tube. A piezo membrane micro pump, controlled by an electrical signal, expels droplets from the outlet. This nebulizer can operate at frequencies enabling the precise delivery of droplets, as seen in ELSD devices.

- **U.S. Patent No. 7,760,355 “Focused Droplet Nebulizer for Evaporative Light Scattering Detector"**

TECHNOLOGY 6: LIGHT SCATTERING DETECTOR

The invention enhances light scattering detection, particularly in evaporative light scattering detection for liquid chromatography. It utilizes a detection cell for suspended particles, a sample light detector, and a light trap with absorptive material aligned with Brewster's angle. Additional features include temperature-controlled ports and a reference cell for noise reduction using cancellation circuitry.

- U.S. Patent No. 8,040,509 “Light Scattering Detector”
- U.S. Patent No. 7,460,234 “Light Scattering Detector”
- U.S. Patent No. 7,268,881 “Light Scattering Detector”

Business opportunity: These technologies can provide a competitive advantage in the highly competitive analytical and measurement equipment market. Issued patent rights are available for option and/or license; however, the licensee should have sufficient know-how for the evaluation, customization (if needed), and implementation of the technology. The inventor is not available for technical guidance or consultation.

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