Australian Scientific Instruments

INSTRUMENTS FOR *INNOVATORS*

Alphachron

Automated Helium Thermochronology

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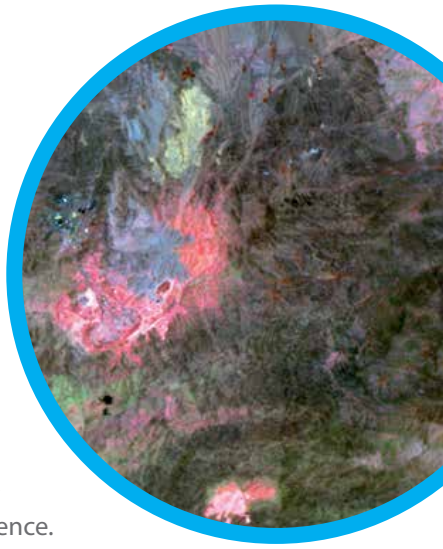

Uranium-helium thermochronometry is a sensitive and cost-effective method of radiometric age dating. This can be used to determine the thermal history of the Earth's crust, with widespread application in both research and economic geology.

This technology is of major benefit to the petroleum and mineral resources industries. Users can quantitatively determine the low temperature thermal histories of mineral belts and petroleum basins. This data is fundamental in the exploration for deposits of minerals, oil and gas.

Instrument Design

The Alphachron™ is a turnkey system for the automated extraction and measurement of radiogenic helium from mineral samples. The instrument integrates a laser-heating of samples with gas-handling and a mass spectrometer, under automated computer control. The system is fully built, calibrated and tested at the ASI manufacuring facility before delivery and is ready to use after rapid installation and minimal commissioning.

Automated Operation

The Alphachron™ is fully automated. Up to 25 individual samples can be loaded into the vaccum chamber which integrates a 980nm diode laser and an automated X-Y stage. Each sample is heated for a user-specified time (typically 5-10 mins) and the extracted gases are then purified, spiked with ^{3}He, and analysed ^{4}He abundance using a quadrupole mass spectrometer.

The gas extraction process is repeated to ensure all the gas has been successfully extracted from the sample, and mineral standards of known age can be included in each analytical sequence to provide quality control.

After determination of the radiogenic ^{4}He amount, the samples are unloaded from the Alphachron™ and the abundances of readiogenic parent uranium and thorium (and if needed samarium) are independently determined using conventional ICP-MS techniques.

Software

Full automation of the Alphachron™ instrument is provided via user-friendly LabView software. This integrates the mass spectrometer, laser diode power supply, X-Y motion controller, video camera and valve sequencing, under PC control.

The software automatically detects and corrects for inconsistent sample orientations, and calculates the relative coordinates of the 25 specimens. If a physical surface feature on the sample causes the laser beam to flare, the vision-based software automatically optimises the position of the laser beam on the sample. A standard video camera with a neutral density and IR filter is calibrated across the thermal range of the glowing sample.

Users can create and adjust the operational sequence of the measurement without any previous programming experience. An intuitive interface helps users manage experiments using scripts – simple text files – that fully control all aspects of the system's automated operation.

Users can create and save separate scripts desired, and eneter them into a simple batch-queue (or sequence) for subsequent analysis, allowing muliple tests on varying samples during a single automated run, without the need for user intervention, or the loading and reloading of samples between tests.

To satisfy tight quality assurance guidelines, the software (with ActiveX calls to Microsoft® Excel™) analyses the results and generates a summary spreadsheet for subsequent offline processing, or the generation of sample and test reports.

Specification

- Reproducibility of $^{4}He/^{3}He$ ratio of spiked ^{4}He gas standards < 0.35% at 1σ
- Blank level of ^{4}He < 0.02 ncc
- Mass range of Quadrupole Mass Spectrometer 0 – 100 AMU
- Resolution 0.5 AMU (10% level)

Delivery and Installation Timeframe

Exact delivery times are dependent on factory production schedules, although typically a new instrument is built, tested, delivered, installed and commissioned in less than 6 months from receipt of order. Installation and training of client personnel is provided by experienced and highly qualified field engineers. Please contact us to discuss your needs.

The Alphachron™ is manufactured in Australia by Australian Scientific Instruments (ASI) under licence from the CSIRO and Patterson Instruments. ASI also manaufactureshe Sensitive High Resolution Ion Microprobe (SHRIMP), which has set the standard for high precision micro-scale U-Pb geochronology around the world for over two decades.

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