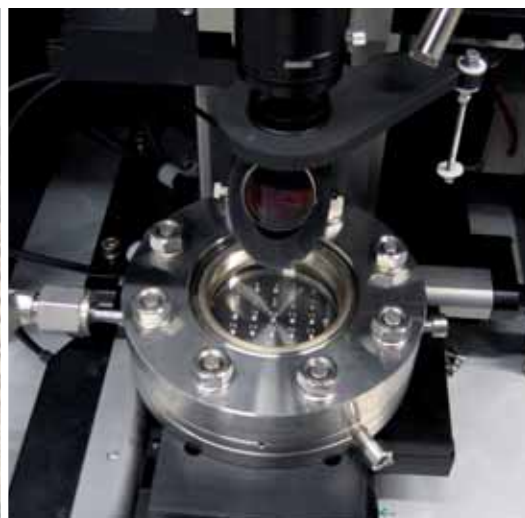


Alphachron™

Automated, Turnkey Thermochronology



*Pioneering the Technique
Perfecting the Technology*



Alphachron™

Uranium-helium thermochronometry is an exciting new, highly 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 module with a gas-handling module and mass spectrometer, under computer control. The system is delivered prefabricated and is ready to use after rapid installation and minimal commissioning.

Automated Operation

The Alphachron™ is fully automated. Up to 25 mineral samples can be loaded into the laser chamber on an automated X-Y stage. Each sample is heated under vacuum for five minutes with a 980 nm diode laser. The extracted gas is spiked with a known quantity of ³He and analysed by isotope dilution with a mass spectrometer. Analysis of a series of gas standards with known volumes of ³He (spike) and ⁴He (standard) is used to determine the unknown ⁴He content of samples.

The gas extraction process is repeated to ensure all the gas has been removed from the sample, and in order to provide each sample with a "blank". Mineral standards are analysed in each group of samples.

The uranium and thorium content of the degassed mineral samples is determined by isotope dilution with ²³⁵U and ²³⁰Th spikes, and a conventional ICP-MS.

Software

The Alphachron™ instrument uses a powerful software package written in LabView. 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 knowledge. An intuitive interface helps users manage experiments using scripts – simple text files – that tightly control all aspects of the system's automated operation.

Users can define separate scripts for each of the samples present on the sample disk, allowing multiple tests on varying samples during one 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

- Gas analysis reproducibility < 0.35% at 1σ
- Background level of ⁴He < 0.02 ncc
- Mass range 0 – 100 AMU
- Resolution 0.5 AMU (10% level)

Options

The Alphachron can be fitted with an optional closed-loop quartz-halogen heating cell, for the controlled release of gas over extended periods, to accurately determine the closure temperatures of minerals.

The Alphachron was developed by the CSIRO Division of Exploration and Mining. It is manufactured under licence from the CSIRO and Patterson Instruments by Australian Scientific Instruments (ASI). ASI manufactures the Sensitive High Resolution Ion Microprobe (SHRIMP IIe), which sets the standard for high precision micro-scale U-Pb geochronology around the world.

Manufactured under licence from CSIRO

