Cryo Mössbauer

MONTANA INSTRUMENTS®
COLD SCIENCE MADE SIMPLE

Transmission Mössbauer Spectrometer for the CRYOSTATION®

CRYOGENIC TEMPERATURE CONTROL ENABLES:

- Study of various iron-bearing phases due to gradual freezing of thermal fluctations.
- Monitoring of structural and magnetic transitions at low temperatures.
- Study of spin crossover behavior.
- Distinguishing non-equivalent crystallographic positions of iron.
- Monitoring size-dependent properties of nanostructured iron-containing materials.

The Cryo Mössbauer offers a complete, integrated solution for variable temperature transmission mössbauer spectra measurements. The MS96 spectrometer is coupled with the Montana Instruments Cryostation sample chamber in a straightforward and user-friendly design. Improve efficiency and quality of results with the combination of two industry-leading performance systems.

Mössbauer Spectrometer

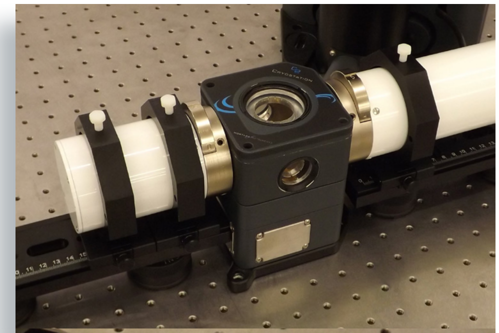
The MS96 Mössbauer Spectrometer utilizes a compact and effective design which is simple to install and operate.

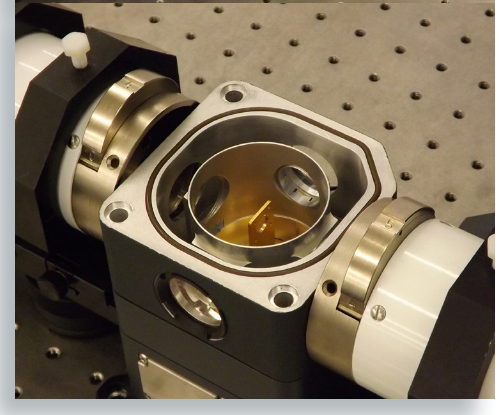
- Experimental bench with detector housing, sample holder, and velocity transducer housing
- Intelligent nuclear detector for detection and signal processing
- Neodymium velocity transducer with analogue PID feedback for precise movement regulation
- Spectrometer main unit with convenient status display

Cryostation® System

The Cryostation provides an automated and controlled environment for low temperature Mössbauer Spectroscopy. The specially designed chamber integrates seamlessly with the source and detector.

- Low cost, helium-free operation
- Fully-automated control
- Versatile & flexible tabletop mounting architecture
- Optimized temperature performance & thermal stability





Performance Data

Low Temperature Mössbauer Spectroscopy

Low temperature Mössbauer spectroscopy is a technique that exploits the temperature dependence of Mössbauer parameters and can be used to explore phenomena like magnetic ordering, hyperfine splitting, and phase or component coexistence of Mössbauer active materials. For example, if the Fe nucleus in magnetite is subjected to a magnetic field (external or internal), its energy levels will split to allow six possible nuclear transitions, and a sextet (six-peak) spectrum results. The positions of the peaks in the sextet correspond to the hyperfine splitting of the nuclear energy levels. When Fe has two distinct binding sites within the crystal lattice, a second sextet can be observed.

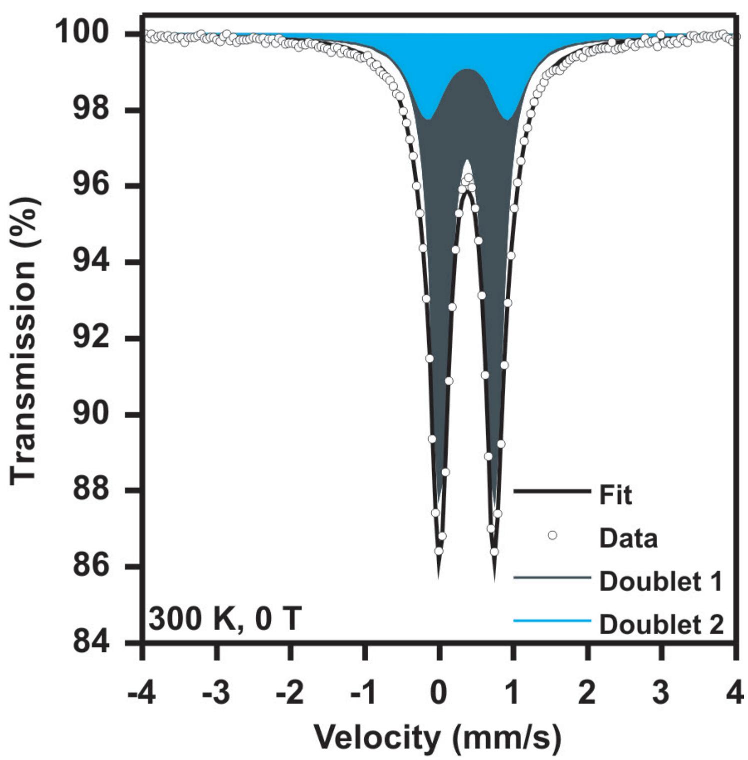


Figure 1: Mössbauer spectra of iron oxide at 300K

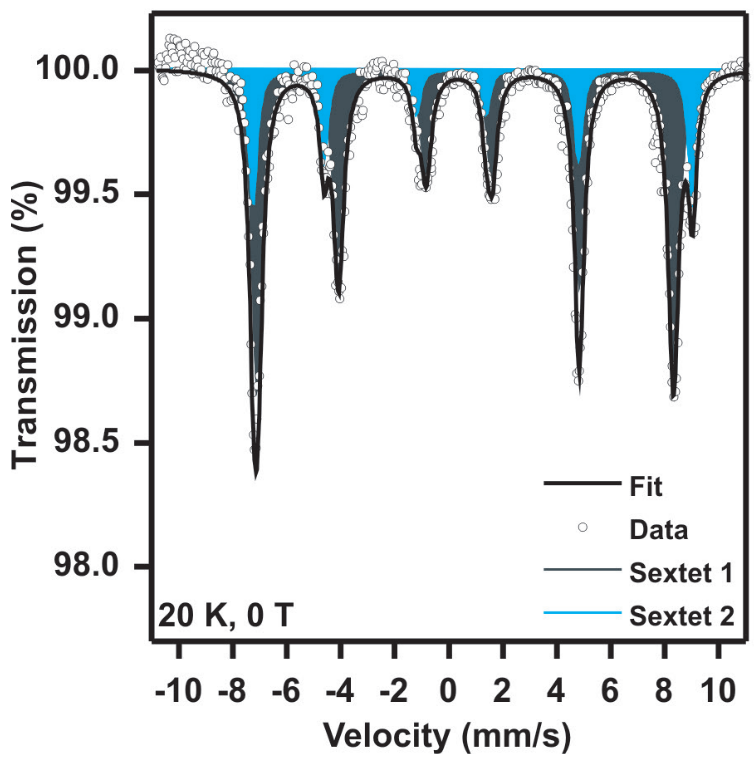


Figure 2: Mössbauer spectra of iron oxide at 20K

Example Measurement

The images above show two Mössbauer spectra taken of an iron oxide sample. In the spectrum of Figure 1, the two doublets associated with two distinct Fe binding locations, shown by blue and gray filled graphs, are perfectly overlapping, thus obscuring spectroscopic signatures of coexisting distinct magnetically ordered components. In the spectrum of Figure 2, the sample was cooled to a cryogenic temperature below the sample's magnetic ordering transition. At this temperature, the doublets are split into to sextets, showing the hyperfine detail. Moreover, the blue and gray spectra no longer overlap perfectly, revealing the presence of two distinct components within the sample.