Murano Heating Stage

Model 525

Many metallurgical and materials science studies benefit from direct observation of specimen heating inside the scanning electron microscope (SEM). The Murano™ heating stage enables phenomena such as phase transformations, recrystallization, grain growth and oxidation to be dynamically observed during heating.

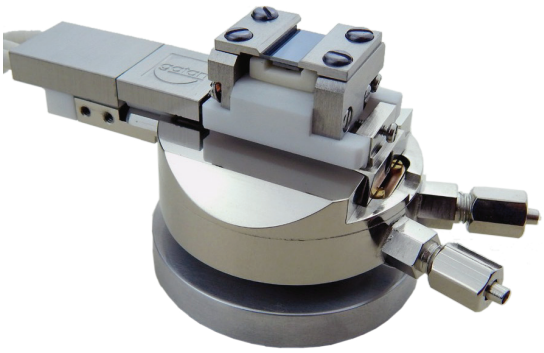
The heating stage is specially designed to interface easily with most standard SEM stages, comprising a thermally isolated interface that is suitable for SEM imaging, Electron backscatter diffraction (EBSD) and focused ion beam (FIB milling). The stage temperature range spans from ambient to 950 °C. To aid catalysis, reduction or oxidation reactions, gas injection is facilitated via an optional capillary adjacent to the sample. External gas flow through the capillary is controlled via a flange-mounted needle valve.

A water-cooled base and shield protects the internal SEM chamber and surrounding detectors. Each system is supplied with a low vibration water chiller that interlocks with a safety flow switch, a power supply and a PC-based temperature controller.

Optimum performance at an elevated temperature is achieved via an integral bias control on the interface flange, suppressing thermionic electrons produced during heating and assisting the extraction of secondary electrons.

The specimen heater platform is a consumable, which has been customized for easy loading. Logging software allows time stamps to be recorded against temperatures.

When used with a DigiScan™ digital beam control and image processing system, temperature data from the Murano heating stage can be stamped on an experiment's images and video recordings using the *in-situ* video software.



Benefits

- **Powerful, *in-situ* heating holder:** Rapid heating and cooling (>100 °C/min) of specimens up to several mm in size
- **Compact design:** Compact size allows wide range of tilt required for EBSD, plus easy device insertion and removal
- **Option for gas injection nozzle:** Allows localized gas reaction studies at high temperatures
- **PC-based temperature controller:** Temperature accuracy <0.5 °C and stability <1 °C/h
- **Water-cooled module:** Protects SEM chamber and allows specimen temperatures of 950 °C

Applications

- Identifying phase transformation and eutectic temperatures
- Characterizing grain growth
- Recrystallization of deformed structures
- Gas reaction studies
- High temperature semiconductor failure analysis

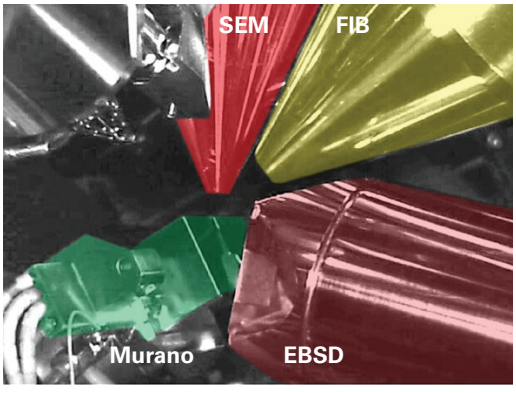


Figure 1. SEM chamber view with EBSD, FIB, and SED.

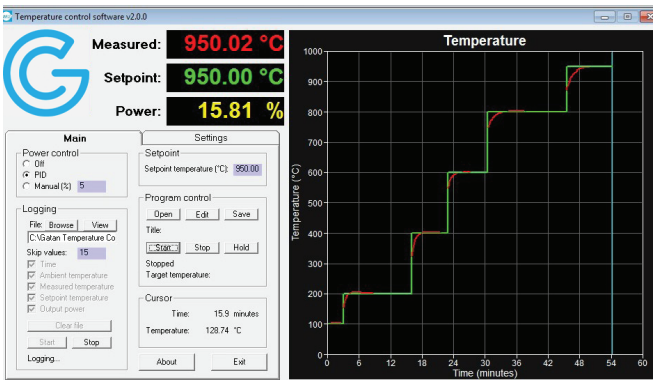


Figure 2. Software allows full temperature control and data logging.

The Murano heating stage opens up *in-situ* experiments, allowing a single specimen to be studied throughout the entire heating range of a SEM session. This enables rapid sample characterization, removing the requirement to prepare multiple samples, while ensuring continuity is maintained for the area of interest.

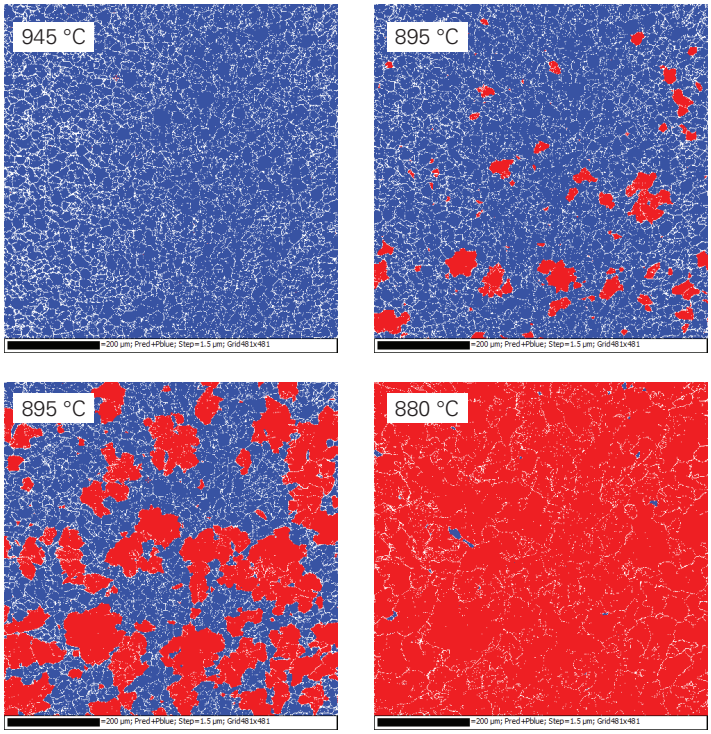


Figure 3. EBSD phase maps showing austenite to ferrite transformation from 945 – 880 °C, austenite is blue (dark) and ferrite is red (light). Measurements were taken using a single low carbon steel specimen heated to 945 °C then cooled at 1 °C/min until the start of phase transformation was observed. Once transformation started, temperature was held to observe development of the phase change in individual grains before cooling resumed. *Data courtesy of Dr. Singh Ubhi from Oxford Instruments.*

Figure 4. Stage is supplied with shields specifically for SED (left) or EBSD (right) imaging.

Specifications

Working distance with shield (mm)	10
Working distance without shield (mm)	12.5
Sample size X (mm)	4.5
Sample size Y (mm)	9
Sample size Z with shield (mm)	1.5
Sample size Z without shield (mm)	3
Max. temperature without shield (°C)	600
Temperature stability (°C)	±0.5
Temperature resolution (°C)	±0.5
Temperature range (°C)	Ambient to 950
Consumable lifetime 900 – 950 °C (h)	10
Consumable lifetime 800 – 900 °C (h)	24
Consumable lifetime <800 °C	100

Specifications are subject to change.

Ordering

Model	Description
525.S	Heating stage module capable of heating to 950 °C, with temperature controller and water cooler
525.G	Optional capillary gas injector and needle valve
525.20000	Additional heated sample holder
525.30000	Consumable heated specimen platform (pack of 5)
525.T	Installation and training (demonstration on Gatan standard samples)
DigiScanSEM	SEM digital beam control and image processing system
718.00	***In-situ*** video software

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