



METALLOGRAPHY EQUIPMENT

ToronTech's Metallography equipment offers its customers value and accuracy at an affordable price. Our range of Metallography machines and instruments includes Cutting, Grinding & Polishing machines, Metallurgical Microscopes and Mounting press machines.

Metallography

Metallography is the study of the physical structure and components of metals, typically using microscopy.

The surface of a metallographic specimen is prepared by various methods of cutting, grinding, polishing, and etching. After preparation, it is often analyzed using optical or electron microscopy. Using only metallographic techniques, a skilled technician can identify alloys and predict material properties.

Mechanical preparation is the most common preparation method. Successively finer abrasive particles are used to remove material from the sample surface until the desired surface quality is achieved. Torontech offers a complete line of machines for mechanical sample preparation for metallography analysis to meet different demands for quality, capacity, and reproducibility.

Metallographic specimens are typically "mounted" using a hot compression thermosetting resin. When specimens are very sensitive to temperature, "cold mounts" may be made with a two-part epoxy resin. Mounting a specimen provides a safe, standardized, and ergonomic way by which to hold a sample during the grinding and polishing operations.

After mounting, the specimen is wet ground to reveal the surface of the metal. The specimen is successively ground with finer and finer abrasive media. After grinding the specimen, polishing is performed. After polishing, certain microstructural constituents can be seen with the microscope, otherwise, the microstructural constituents of the specimen are revealed by using a suitable chemical or electrolytic etchant.

Spectroscopy

Spectroscopy and spectrography is the measurement of radiation intensity as a function of wavelength. Spectral measurement devices are referred to as spectrometers, spectrophotometers, spectrographs or spectral analyzers.

Optical emission spectrometry (OES) and X-Ray fluorescence are the most commonly used techniques for the analysis of metals and solid samples. It is crucial to have the sample properly prepared. The sample needs to be both representative, homogeneous and with an even surface in order to eliminate factors that can influence the results.

The surface spectroscopy sample is prepared by various methods of cutting, grinding and polishing, Successively finer abrasive particles are used to remove material from the sample surface until the desired surface quality is achieved. Torontech offers a complete line of machines for mechanical sample preparation for spectroscopy analysis to meet different demands for quality, capacity, and reproducibility.

Petrography

Petrography is the study of origin, composition, distribution and structure of rocks. The mineral content and the textural relationships within the rock are described in detail. The classification of rocks is based on the information acquired during the petrographic analysis with petrographic microscope.

The detailed analysis of minerals by optical mineralogy in thin section and the micro-texture and structure are critical to understanding the origin of the rock. Electron microprobe analysis of individual grains as well as whole rock chemical analysis by instruments such as atomic absorption analyzers and X-ray fluorescence analyzers.

The surface of a rock specimen is prepared by various methods of cutting, grinding and polishing, Successively finer abrasive particles are used to remove material from the sample surface until the desired surface quality is achieved. Torontech offers a complete line of machines for mechanical sample preparation for Petrography analysis to meet different demands for quality, capacity, and reproducibility.

Compare Metallography Equipment Categories

Side-by-side overview of Torontech metallography equipment to help you choose the right tool for your workflow.

Feature	Metallurgical Microscopes (ToronMM™ Series)	Metallurgical Image Analysis Software (ToronMat+™)	Metallography Abrasive & Precision Cutters	Grinding & Polishing Equipment	Metallography Mounting Media
Workflow stage	Inspection and microstructure observation	Measurement, documentation, and reporting	Sectioning and sample cutting	Surface preparation before microscopy	Specimen mounting, safe handling, and retention
Primary purpose	Reveal microstructural constituents using metallurgical optics	Quantify features and standardize analysis results	Prepare specimens with controlled cutting for metallography	Grind and polish specimens to achieve analysis-ready surfaces	Encapsulate specimens using hot mounting media
Best for	QC labs, failure analysis, R&D, materials characterization	Consistent image analysis, grain/phase quantification, documentation	Metals, ceramics, composites, and hard materials sectioning	Repeatable surface prep for microscopy and analysis	High-throughput processing of delicate or unstable materials
Typical output	Microscope images and visual microstructure evaluation	Measurements, annotations, and analysis reports	Sectioned specimens ready for grinding/polishing	Polished specimens ready for microscopy or etching	Mounted specimens ready for grinding/polishing
Common decision driver	Need reliable metallographic imaging and observation	Need repeatable measurement and documentation of microstructure	Need controlled, clean cuts to preserve sample integrity	Need reproducible surface finish and throughput	Need consistent edge retention and safe handling

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Selection tip	Choose if your priority is microstructure observation	Choose if you want standardized measurement and reporting	Choose if you need the right cutter for your specimen type	Choose if surface preparation is your bottleneck	Choose if you need high quality in results

APPLICATIONS

Metallography equipment prepares and examines the microstructure of metals and other materials. Studying microstructure reveals how a material was processed and how it will perform, which makes metallography essential to quality control, research, and failure analysis.

Quality Control and Material Verification

Confirm grain size, phase distribution, and coating thickness against specification. Microstructural checks support material certification and incoming inspection under standards such as ASTM E3.

Failure Analysis

Examine cracks, fractures, and defects to find the root cause of a component failure. Prepared cross-sections show how and where a part began to fail.

Weld and Heat-Treatment Inspection

Evaluate weld penetration, heat-affected zones, and case depth from surface hardening. These measurements confirm that processes were carried out correctly.

Research and Development

Study new alloys, composites, and surface treatments by linking microstructure to mechanical performance during material development.

FEATURES

1. Complete Sample Preparation Workflow

The equipment range covers each stage of preparation, from sectioning and mounting to grinding, polishing, and etching, so a laboratory can build a full metallography lab from one source.

2. Precision Sectioning

Abrasive and precision cutters remove a representative sample while limiting heat and deformation, which protects the true microstructure for analysis.

3. Hot and Cold Mounting

Mounting presses and cold-mount options encase specimens for safe, repeatable handling during grinding and polishing.

4. Controlled Grinding and Polishing

Grinder-polishers produce flat, scratch-free surfaces through a staged sequence, which is the key to clear microstructure imaging.

5. Manual and Automatic Options

Manual units suit lower volumes and teaching, while automatic systems deliver consistent results and higher throughput for

busy laboratories.

6. Standards-Based Preparation

The workflow supports recognized methods such as ASTM E3 for metallographic specimen preparation, which keeps results comparable and defensible.

THEORY & METHOD

Working Principle of Metallographic Specimen Preparation

Metallography studies the microstructure of a material by preparing a representative surface and examining it under magnification. The goal is to reveal the true grain structure, phases, inclusions, pores, and deformation features without introducing preparation damage that could distort the result.

- **Sectioning:** A specimen is removed from the parent part with controlled cutting conditions so heat and mechanical deformation do not alter the original microstructure.
- **Mounting:** The specimen is embedded in hot or cold mounting media to protect edges and make handling consistent during later preparation steps.
- **Grinding:** Successively finer abrasives remove saw damage and flatten the surface until the specimen reaches a uniform plane.
- **Polishing:** Fine abrasives and polishing cloths reduce the remaining deformation layer and produce a reflective surface suitable for microscopic examination.
- **Etching:** A controlled chemical or electrolytic etchant selectively attacks phases or grain boundaries so the microstructure becomes visible.
- **Microscopy and image analysis:** Optical or digital systems then evaluate grain size, phase distribution, coating thickness, weld quality, inclusions, and other features relevant to quality control, research, and failure analysis.

Reliable metallography depends on controlling pressure, speed, abrasive sequence, lubrication, and specimen orientation at each stage. When preparation is consistent, the final image reflects the material itself rather than artifacts from the



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