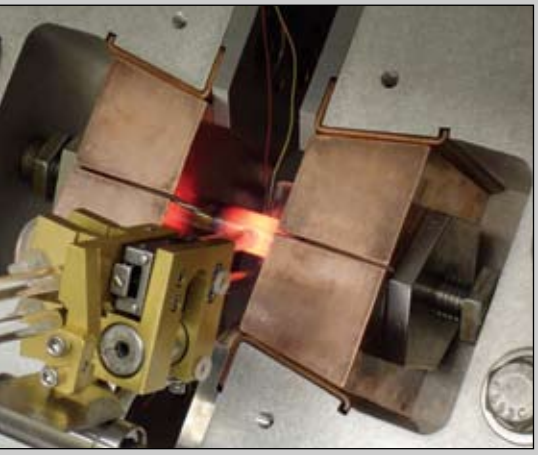
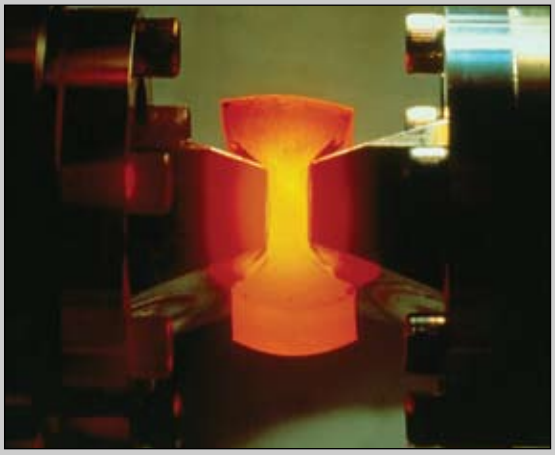
GLEEBLE®

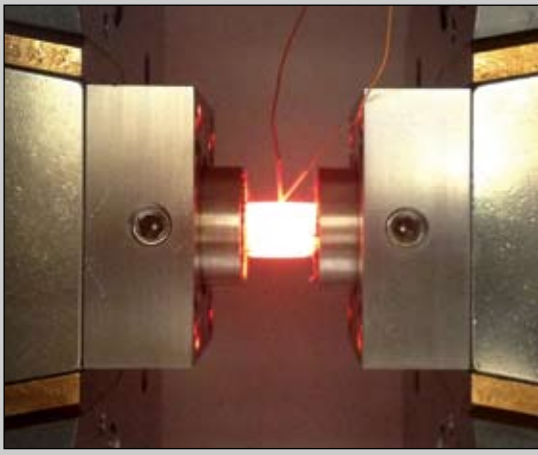
DYNAMIC SYSTEMS INC. 60 Years of Excellence 1957 2017 www.GLEEBLE.com

Thermal-Mechanical Simulators

A Complete Family of Research Tools to Improve Materials, Optimize Processes & Increase Profits







Physical Simulation is a valuable tool used to study metallurgical processes, develop new materials and replicate real world conditions in the laboratory.

Lower Costs - Reduce product development, processing & energy costs

Optimize Manufacturing Processes - Develop new procedures & troubleshoot existing processes

Optimize Materials - Develop new materials and applications

Increase Production - Reduce scrap and maximize output and efficiency

Faster Product Development - Reduce time to market and R&D expense

Improved Product Quality - Improve product consistency and quality

Materials researchers are frequently asked to extend the boundaries of what is possible in their industries. To help in this quest, Dynamic Systems Inc. (DSI) has developed a comprehensive line of dynamic thermal-mechanical physical simulators and testing machines.

Whether you need to characterize new materials, optimize existing processes, explore new production techniques, or simulate the conditions of new applications, you will find there is a Gleeble system that will help you reduce costs, shorten development times, and open the door to new ideas, processes and profits.

Gleeble systems feature high-speed closed-loop heating systems coupled with robust closed-loop mechanical capabilities and digital control. Easy to use computer software is designed to provide a user-friendly interface to prepare test programs, control thermal and mechanical systems, and collect data.

Whatever your goal, there is a Gleeble system that will help you extend the reach of your investigations and provide the state-of-the-art tools required for today's modern laboratory.

Table of Contents:

Popular Gleeble Applications

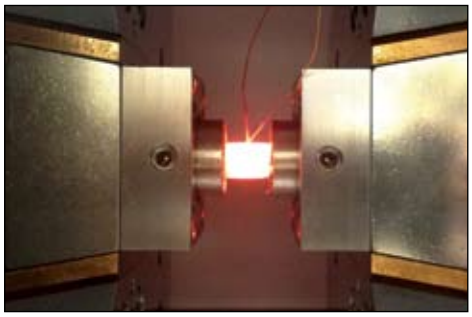
Materials Testing

- Hot/warm tensile testing on a wide variety of specimen geometries
- Hot/warm compression testing
  - Uniaxial compression
  - Plane strain compression
  - Strain Induced Crack Opening (SICO)
- Stress vs. Strain curves
- Melting and solidification
- Nil-strength testing
- Hot ductility testing
- Thermal cycling/heat treatment
- Dilatometry/phase transformation
  - During heating or cooling
  - Continuous or non-continuous
  - Isothermal
  - Post deformation
- Stress relaxation studies
- Creep/stress rupture
- Fatigue
  - Thermal fatigue
  - Thermal/mechanical fatigue

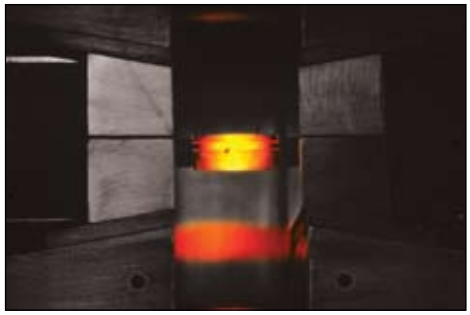
Process Simulation

- Continuous casting
- Mushy zone processing
- Hot rolling
- Forging
- Extrusion
- Weld HAZ cycles
- Upset butt welding
- Diffusion bonding
- Continuous strip annealing
- Heat treating
- Quenching
- Powder metallurgy/sintering
- Self-Heating Synthesis (SHS)
- Brazing
- Liquid metal embrittlement

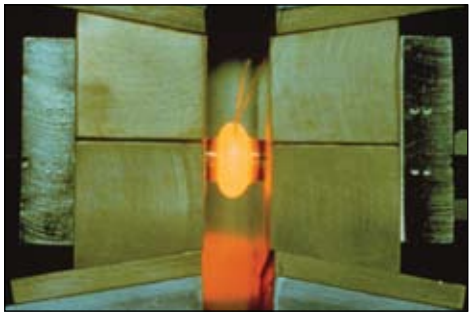
Thermal Cycles and Heat Treatments: Many different grips are available to support uniform temperature zones and a variety of specimen configurations. Other grips can be used to provide thermal gradients in the specimen for weld HAZ and process simulation.



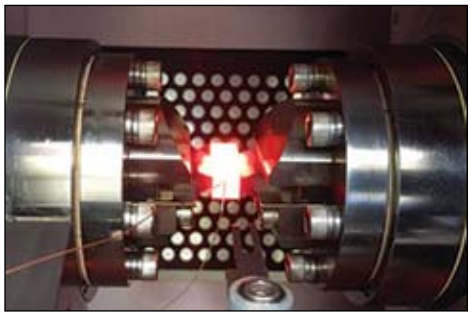
ISO-T Flow Stress Compression Testing: ISO-T flow stress compression anvils provide a uniform temperature distribution throughout the compression specimen during single and multiple-hit deformation tests.



Melting and Solidification: Melting and controlled solidification can be performed in-situ. Thermal and mechanical testing of the as-cast structure can then be performed to identify cast structure properties and ductility dip regions.



Strain Induced Crack Opening (SICO) Procedure: The SICO procedure is a quick and cost-effective method for thermomechanical process optimization in forging and forming operations.



Hot/Warm Deformation: Shown above is a plane strain compression test. In single or multiple-hit compression tests, strain and strain rate are controlled separately yet synchronously using the optional Hydrawedge, simulating hot rolling or multi-hit hot forging.

Strip Annealing Process Simulation: Both batch and continuous annealing processes can be simulated using a strip annealing jaw system.

Gleeble 3000 Series

The Standard for Thermal-Mechanical Simulators

Now equipped with Gleeble Touch Control (GTC) Technology

Gleeble systems are available in several models, each with a wide variety of available options and configurations. This flexibility allows the tailoring of a Gleeble system to meet your exact testing requirements. Available options include transducers, load cells, contact and non-contact extensometers, infrared pyrometers, quench systems, jaws, grips and vacuum systems.

The most popular machines are the Gleeble 3180-GTC, Gleeble 3500-GTC and Gleeble 3800-GTC. Mobile Conversion Units (MCUs) are available for 3500-GTC and 3800-GTC models which provide application-specific capabilities. MCUs include the Hydrawedge, MAXStrain, Hot Torsion and the new Ultra High Temp System. Gleebles can also be modified to conduct testing in beam lines and can be equipped with a Laser Ultrasonic Measurement System (LUMet) for real-time microstructure monitoring.

Gleeble 3180-GTC

The Gleeble 3180-GTC provides a physical simulation system for researchers who require the quality and accuracy of a Gleeble system on an affordable scale. The Gleeble 3180-GTC is ideal for weld HAZ simulations, hot tensile tests, thermal cycles, heat treatment studies, uni-axial compression and low force tests.

Gleeble 3500-GTC

The Gleeble 3500-GTC is the industry standard for thermal mechanical physical simulation. With its high-speed heating and wide range of mechanical capabilities, the Gleeble 3500-GTC is ideal for weld HAZ simulations, nil-strength, thermal cycles, heat treatment studies, low force tests, hot tensile tests, high-speed compression, multi-hit hot deformation tests, melting and solidification, and strip annealing simulations.

Gleeble 3800-GTC

The Gleeble 3800-GTC is the most powerful Gleeble, available with a mechanical system capable of exerting as much as 20 tons of static force. This system can be equipped for the same applications as a Gleeble 3500-GTC, however with twice the force and speed, it is particularly well suited for hot rolling and multi-hit forging simulations. The additional force and speed provides the ability to use larger samples, test stronger materials, achieve higher strain rates and test at lower temperatures.

Gleeble 500 Series

ALL NEW!

An All-New Platform of Research Systems Optimized for Performance, Versatility and Value.

The 500 Series of Gleeble systems are tailored to provide a compact, economical solution for researchers while retaining the world-class capabilities that have made Gleeble systems the industry standard.

Features Include:

- High-speed, direct resistance heating up to 10,000°C/second
- Controlled cooling or accelerated cooling with optional quench (air/gas/water/mist)
- Simulation of multiple applications, processes and materials
- Ability to test in vacuum, air or inert gas
- User friendly and easy to use controls and software
- Quiet operation, easy installation and a small laboratory footprint

The Gleeble 500 Series includes the Gleeble 540 Welding Simulator and the Gleeble 563 Thermal-Mechanical Simulation (TMS) System. While these economical and compact systems require a lower investment, they are able to perform a wide range of testing and process simulations, including:

Material Testing Capabilities of the Gleeble 540 & Gleeble 563:

- Hot Ductility and Hot Tensile Testing on a Wide Variety of Specimen Geometries
- Strain Induced Crack Opening (SICO)
- Stress vs Strain Curves
- Melting and Solidification
- Nil-Strength Testing
- Thermal Cycling/Heat Treatment
- Weld HAZ Simulations
- Charpy Specimen Heat Treatment
- Study of Local Brittle Zones
- Embrittlement and Crack Susceptibility
- Liquid Metal Embrittlement
- Welding/HAZ Phase Transformation Studies
- Creep/Stress Rupture
- Low Cycle Thermal-Mechanical Fatigue

Gleeble 540: Welding Simulator

Over 60 years ago, the Gleeble was developed to study weld HAZ. While Gleeble systems have evolved and grown over time, the new Gleeble 540 Welding Simulator again focuses on applications necessary for welding research. However, the 540 performs much more than just HAZ simulations, adding a wide range of capabilities including studies of ductility, crack susceptibility, nil-strength determination and much more.

Gleeble 563: TMS System

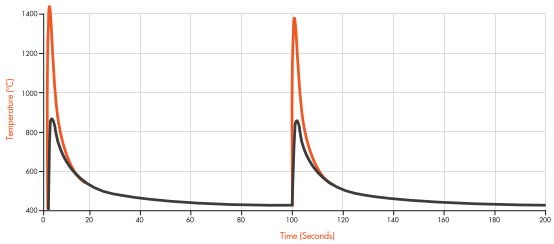
The Gleeble 563 Thermal-Mechanical Simulation (TMS) System can perform all of the testing capable in the Gleeble 540 and adds the ability to conduct additional deformation testing, including uniaxial and plane strain compression tests. The flexibility of the 563 delivers maximum value by enabling researchers to conduct many different types of tests and simulations with a minimum investment.

The Gleeble 563 also offers the following capabilities:

- Hot Compression Testing, including Uniaxial and Plain Strain Studies
- Stress Relaxation
- Phase Transformations Studies, including CCT/TTT Curve Development With and Without Deformation

Both 540 and 563 models feature new touch-screen based control systems. This new user interface makes setting up and running tests much faster and easier than traditional control systems.

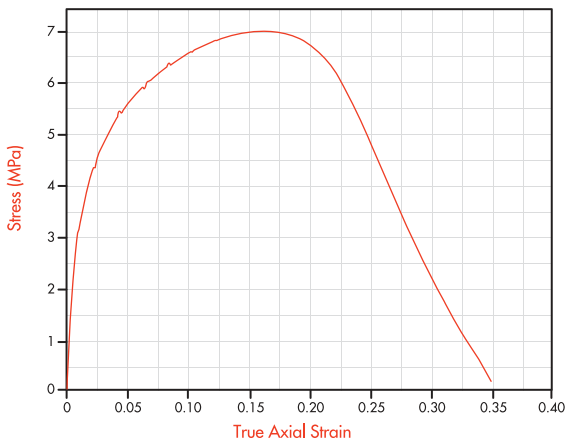
HAZ Simulation of Successive Weld Passes



Weld HAZ simulations can reproduce thermal gradients and characteristics at any location in a weld. The graph shows the thermal profile of two locations during a multi-pass weld.

Direct resistance heating provides extremely fast heating rates with precise control. Water-cooled jaws contribute to very fast cooling rates and enable researchers to simulate steep thermal gradients.

Stress vs Strain Plot



Stress vs Strain curves can be created over a wide range of temperatures, from room temperature up to 1700°C.

ALL NEW!

Gleeble Touch Control

GLEEBLE TOUCH CONTROL

The Next Generation of Gleeble Systems Control

Gleeble Systems come equipped with control and data analysis software, including the All New **G**leeble **T**ouch **C**ontrol (GTC) System, which controls thermal and mechanical functions. QuikSim®2 software is a user-friendly interface enabling Gleeble operators to program and control the system as well as collect test data. Additionally, robust data analysis software is included, **making it easier than ever to generate and analyze data.**

All-New Touch Screen Display
- Intuitive and easy to use
- Large screen and simple icons
- Clear presentation of key data

Quick Function Panel
- Power Switch
- Reset Switch
- Emergency Stop

Gleeble systems come standard with a workstation that includes a desk with work surfaces that feature superior resistance to scratches and stains, a well-equipped desktop computer, printer, monitor, keyboard and mouse.

Wireless communication with work station reduces wire clutter

Lower Panel
- Large touch reactive control knobs make system adjustment easier and more accurate
- Ergonomically designed for added user comfort
- Standard buttons include: Run, Stop, Mechanical, Door Lock

GTC utilizes modules to maximize compatibility with external measurement systems & accessories

Features Include:
- Simultaneous thermal and mechanical control
- Manual and/or computer control
- Smooth transitions in mechanical control mode
- Measurement units easily configured by user
- High-speed data acquisition
- Test progress readout via Virtual Panel Meters (VPMs)
- Capable of system variable adjustments while a test is running

QuikSim®2 Software
- User friendly interface for programming and controlling the Gleeble System
- Independent workstation with full windows multitasking during testing
- Highly flexible
- Fast set-up times allow users to run more tests in less time
- Password protection
- Arbitrary waveform generation
- Three programming methods available:
  - Table form (fill in the blanks)
  - Optional Deformation Control Software for sequential multi-hit deformantion
  - Gleeble Script Language (GSL) for maximum versatility

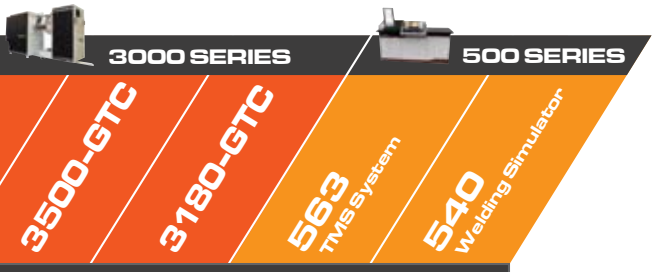
Data Processing
- Powerful and flexible data processing
- Publication quality data plots and graphs
- User created templates save considerable time when completing repetitive tasks
- Built-in mathematical functions
- Automatic data file loading, "Copy & Paste" or link data to other applications

Available as an UPGRADE to existing Gleeble Systems

Gleeble System Comparison Chart

The Gleeble family of systems is growing. Find out which system is the right fit for your engineering challenge. DSI offers a range of Gleeble models, each of which are flexible and customizable to achieve a wide range of applications. The chart below lists popular Gleeble systems with key specifications and a comparison of applications and research capabilities.

The guide below is a good place to start, however to identify the best solution for your needs and budget please reach out to one of our system experts today at Info@Gleeble.com to discuss your research needs and model/configuration options.



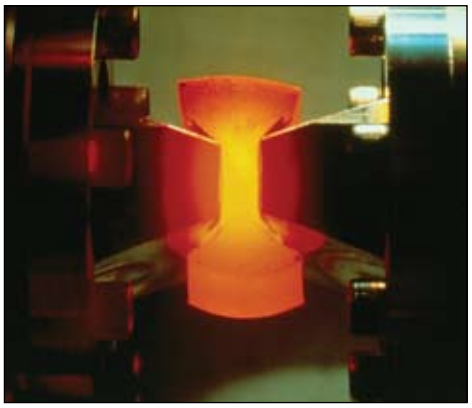
Force	Maximum Compressive Force	20 Metric Tons	10 Metric Tons	8 Metric Tons	3 Metric Tons	3 Metric Tons
	Maximum Tensile Force	10 Metric Tons	10 Metric Tons	8 Metric Tons	3 Metric Tons	3 Metric Tons
Stroke	Maximum Stroke Distance	125mm	100mm	100mm	100mm	100mm
	Maximum Stroke Rate	2000mm/sec	1000mm/sec	1000mm/sec	200mm/sec	200mm/sec
	Minimum Stroke Rate	.001mm/sec	.001mm/sec	.01mm/sec	.01mm/sec	.01mm/sec
Temperature Control*	Maximum Temperature	3,000°C*	3,000°C*	1,700°C	1,700°C	1,700°C
	Maximum Heating Rate	10,000°C/sec	10,000°C/sec	8,000°C/sec	10,000°C/sec	10,000°C/sec
	Maximum Quenching Rate*	10,000°C/sec	10,000°C/sec	10,000°C/sec	10,000°C/sec	10,000°C/sec
	Maximum Specimen Size	20mm dia	20mm dia	12mm dia	11mm sq	11mm sq
Mobile Conversion Units	Torsion MCU	✓	✓	—	—	—
	Hydrawedge MCU	✓	✓	—	—	—
	Strip Annealing MCU	✓	✓	—	—	—
	High Temp Testing MCU	✓	✓	—	—	—
	MAXStrain® MCU	✓	—	—	—	—
	LUMet	✓	✓	—	—	—
Applications & Research Areas*	Hot Tensile Testing	✓	✓	✓	✓	✓
	Uniaxial Compression — *High Speed*	✓	✓	—	—	—
	Uniaxial Compression — *Low Speed*	✓	✓	✓	✓	—
	Plane Strain Compression — *High Speed*	✓	✓	—	—	—
	Plane Strain Compression — *Low Speed*	✓	✓	✓	✓	—
	Dilatometry — *Static Dilatometry*	✓	✓	✓	✓	—
	Dilatometry — *Deformation Dilatometry*	✓	✓	✓	✓	—
	Strain Induced Crack Opening (SICO)	✓	✓	✓	✓	✓
	Heat Treating	✓	✓	✓	✓	✓
	Melting & Solidification	✓	✓	✓	✓	✓
	Welding Studies & Weld HAZ	✓	✓	✓	✓	✓
	Nil-Strength	✓	✓	✓	✓	✓
	Rolling Simulation	✓	✓	—	—	—
	Multi-Axis Forming *(Creation of Ultrafine-grains & Nano Materials)*	✓	—	—	—	—
	Continuous Casting	✓	✓	✓	✓	✓
	Mushy Zone Processing	✓	✓	✓	✓	✓
	Forging	✓	✓	✓	✓	—
	Stress Relaxation	✓	✓	✓	✓	✓
	Strip Annealing	✓	✓	—	—	—
	Extrusion	✓	✓	✓	—	—
	Torsion Testing	✓	✓	—	—	—
	Powder Metallurgy/Sintering	✓	✓	—	—	—
	Quenching (Water/Air/Gas/Mist)	✓	✓	✓	✓	✓
	Recrystallization & Grain Growth	✓	✓	✓	✓	✓
	Fatigue (Thermal/Thermal-Mechanical)	✓	✓	✓	✓	—
	Friction Stir Welding	✓	✓	—	—	—

* Optional equipment may be required.

MCU: Hydrawedge®

COMPATIBLE WITH 3500 COMPATIBLE WITH 3800

The Ultimate Tool for Optimizing Hot Rolling & Forging Processes

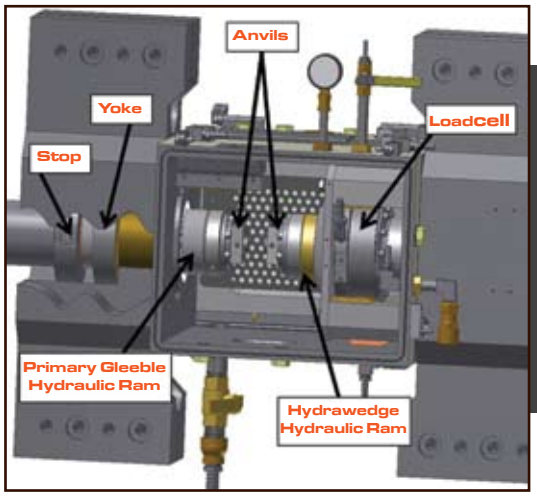


For researchers who wish to optimize multiple-hit, high-speed deformations — including multi-stand rolling mills and multi-hit forging processes — the Hydrawedge offers excellent physical simulation capabilities.

Available as an option for Gleeble 3500-GTC or 3800-GTC systems, the Hydrawedge is the only commercially available machine that offers the capability to perform high-speed deformation simulations with complete independent control of both strain and strain rate.

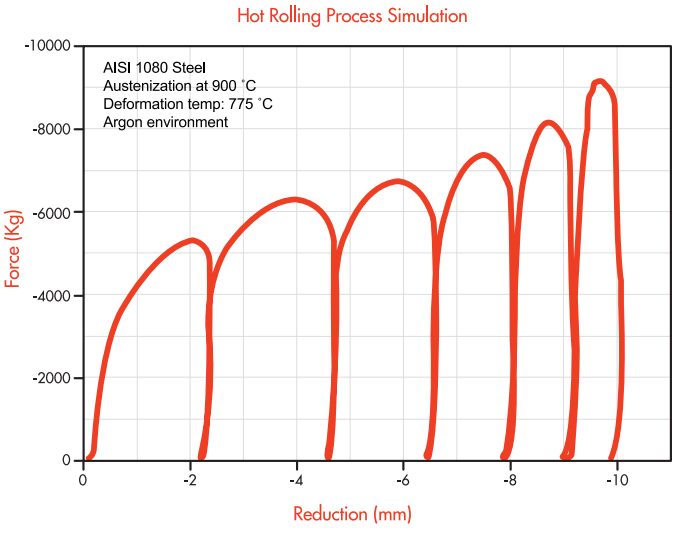
Through its patented technology, the Hydrawedge delivers test results without strain overshoot or strain rate deceleration, either one of which can reduce the validity of the simulation.

The Hydrawedge control software allows the system to be programmed with the same parameters as a rolling mill schedule. Enter temperature, soaking times, rolling temperature, interpass time, controlled cooling time, strain rate and amount of strain for each stand; the software then calculates and programs how to run that schedule on the Hydrawedge.

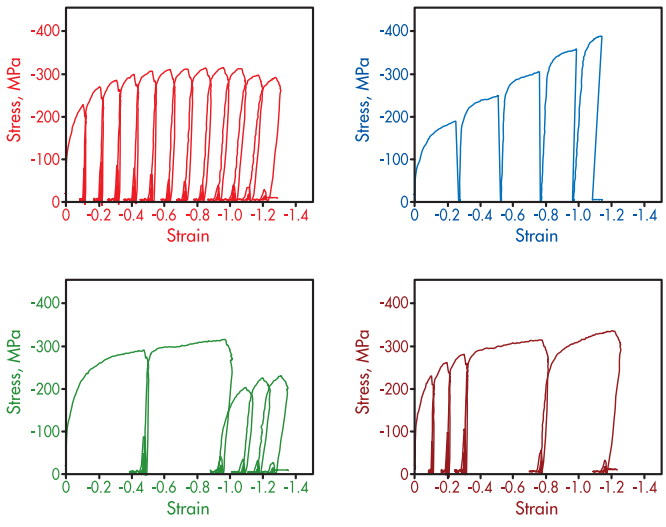


The patented Hydrawedge system is capable of multiple compressions at strain rates of up to 100/s allowing the accurate replication of an entire hot rolling or multi hit forging process — from reheating, through multiple stand rolling, to controlled cooling.

- Multiple hits at high speed
- Independent control of strain and strain rate
- Mechanical stop eliminates deformation overshoot



The Gleeble Hydrawedge can simulate a wide variety of rolling schedules



MCU: Hot Torsion

COMPATIBLE WITH 3500 COMPATIBLE WITH 3800

High-Speed Thermal and Mechanical Capability

The Hot Torsion Mobile Conversion Unit (MCU) adds world-class hot torsion testing capability to Gleeble® 3500-GTC and 3800-GTC Systems. Capable of applying torque up to 100 Nm (50 Nm standard configuration), Hot Torsion Systems from Dynamic Systems are the first commercially available torsion systems to incorporate direct resistance heating.

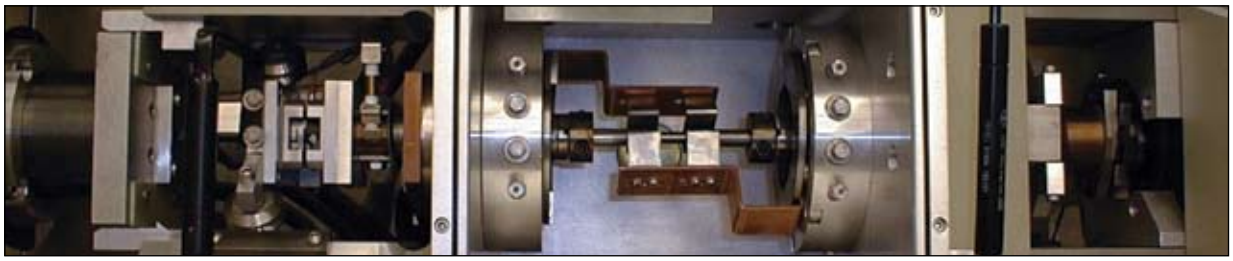
The model 35050 Hot Torsion Testing MCU uses a roll-on/roll-off design which allows the base Gleeble 3500-GTC and 3800-GTC to be easily converted to a hot torsion testing configuration.

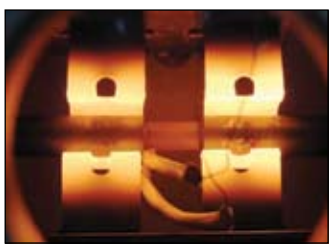
Features Include:

- Rapid, uniform direct resistance heating of samples
- Heating of test specimens at any time during torsion
- Rapid in-situ quenching of the test specimen at any point in the test
- Quench with air, water or mist
- Apply controlled tension or compression (5 kN, 1,100 lbs limit) axially during torsion
- Torsion tests can be conducted with full axial restraint or no axial restraint
- High-speed hydraulic torque motor for rapid strain rate changes (1,500 RPM top speed)
- Variable torsion coupler for higher acceleration speeds
- Free coupler minimizes strain error during specimen loading
- Additional specimen furnace available to extend the uniform temperature zone

Additional Features:

- Tests may be performed in vacuum (10^{-2} torr), inert gas or air
- Temperature is controlled by a thermocouple attached to the fixed side of the specimen hotzone
- Specimen size: Gage length diameter: 6 mm to 10 mm diameter Gage length: 6 mm to 50 mm
- Longitudinal load cell with overload protection provides measurement of axial load on specimen
- Torque cell with overload protection provides accurate torque measurements during test
- Axial load control provides combined stress states such as tensile or compressive shear
- Optional quench systems can be used to accelerate cooling or to freeze microstructures of the specimen





MCU: MAXStrain®

COMPATIBLE WITH 3800

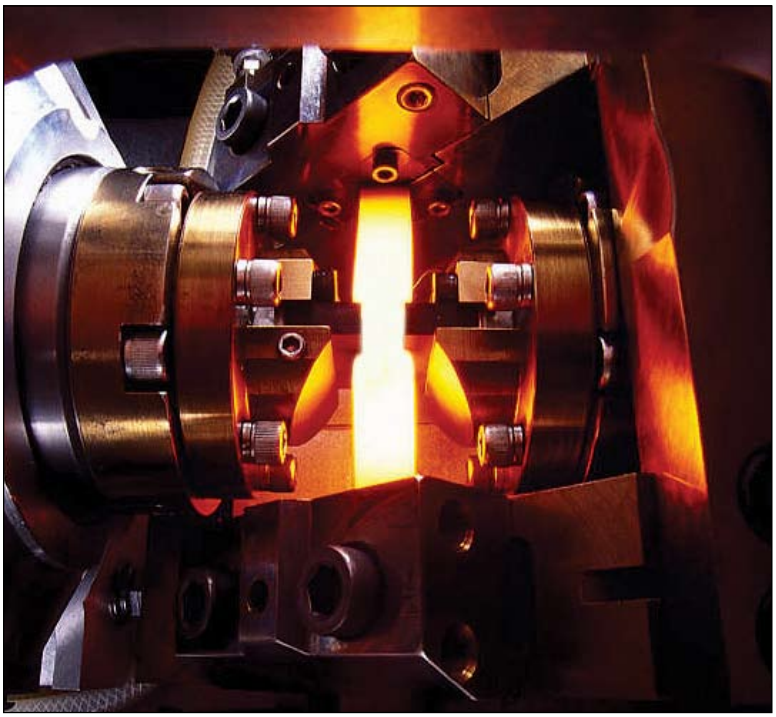
A Research Tool for Making Ultrafine-Grain and Nano Materials

The MAXStrain multi-axis hot deformation system is a unique research tool that can subject materials to virtually unlimited strain under precise control of strain, strain rate, and temperature.

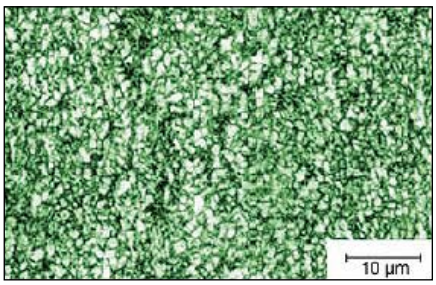
Specimens loaded into the MAXStrain are heated and rotated 90 degrees between multiple, successive compressions. The system restrains specimens lengthwise while allowing unlimited deformation in the other two dimensions. As a result, very high strain levels can be introduced into specimens to produce a sample of ultrafine-grain or nanoscale material that is large enough for subsequent properties testing.

The MAXStrain system can be used on steels, aluminum alloys, titanium, and other metals.

The MAXStrain provides unparalleled, accurate control of all parameters, thereby offering a high degree of reproducibility. Researchers quickly and precisely create materials in the laboratory under well controlled mechanical and thermal conditions.



A steel MAXStrain specimen is heated via direct resistance while anvils deform the center section. Each end of the specimen is constrained and the specimen is rotated 90 degrees before the next compression.



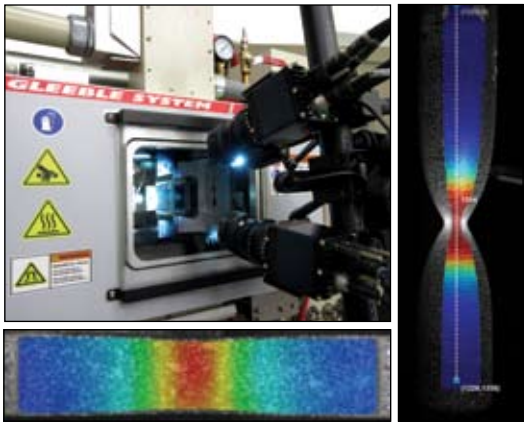
Ultrafine-grain or nano-scale material can be produced due to the exceptionally high strain levels achieved in the specimen. The large specimen size enables further tests on the same sample.

Measurement Systems

Digital Image Correlation Systems

Digital Image Correlation (DIC) can be used in conjunction with Gleeble systems for 3D non-contact optical measurements of deformation and strain. DSI has developed a successful combination of high performance cameras, lighting, mounting and licensed software to produce accurate results, even at elevated temperatures (up to 1,100˚C).

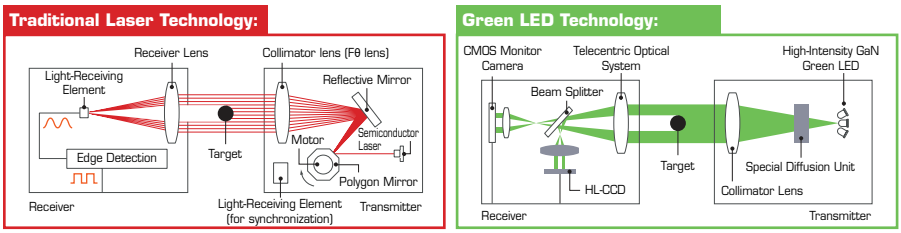
Digital Image Correlation can be utilized on a number of standard Gleeble tests including tensile tests, Strain Induced Crack Opening (SICO), flow stress compression, as well as other standard and custom simulations.



Scanning Non-Contact Optical Dilatometer and Extensometer with Green LED Technology

Optical System Achieving High-Speed, High-Accuracy, and High-Durability. The system uses a high intensity GaN long life LED combined with an HL-CCD sensor to provide high speed measurements with no moving parts. This unit has twice the speed of conventional laser based measuring units.

Easy to use menu driven setup software is included with the unit to allow configuration of the controller on the desktop PC.

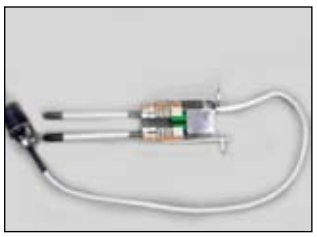


More Accurate and Easier to Use: Green LED technology achieves both quick and accurate measurement reliably and durably.

Contact Measurement Systems

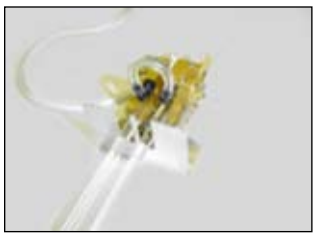
DSI offers a range of highly accurate contact extensometers that can be utilized for a variety of measurements, both crosswise and lengthwise on wide range of specimen types, both in and out of the specimen's hot zone. Both LVDT and strain gauge measurement systems are available. These components have been designed to be easy to install and operate. Some of the more popular systems are listed below:

39060 - Hot Zone L-Strain:
An LVDT type hot zone transducer commonly, used for tensile tests or simulations with large amounts of deformation in tension or compression. (25mm travel)



39071 – Hot Zone L-Strain:
A strain guage type hot zone transducer, commonly used for tests requiring high resolution with small amounts of travel. (5mm of travel in tension, 2mm of travel in compression)

39010 C-Gauge:
Crosswise LVDT type gauge with large travel (12mm) measures significant deformation.



39018 Dilatometer:
Highly accurate and reliable, the Dilatometer is commonly used to generate CCT/TTT data.

Specialty Systems:

As research needs evolve, DSI has responded by creating custom equipment with unique capabilities. For more information on these systems, or to inquire about the creation of new research tools, please contact your local DSI representative to discuss requirements and specifications.

GLEEBLE® STRIP ANNEALING

DSI offers a range of options for studying strip annealing processes. With optional fixtures, sheet specimens (50 mm x 260 mm) can be tested in the standard Gleeble 3500/3800 vacuum tank. Additionally, DSI offers a dedicated MCU for simulating strip annealing on larger samples (127 mm x 254 mm) which can be subjected to additional tests such as formability simulations.

GLEEBLE® ULTRA HIGH TEMP

Used for applications that require high temperatures (up to 3,000°C) the Ultra High Temp MCU offers enhanced capabilities to accommodate more demanding requirements. The system features additional grounding paths for improved resistive heating and increased system cooling. The unit is based on the standard 3500/3800 General Purpose MCU which allows for the use of standard specimen grips.

GLEEBLE® BEAMLINE

Gleeble systems can be customized to operate in various types of beam lines for unprecedented in-situ materials studies during specific thermo-mechanical conditions.

Specialty Systems:

COMPATIBLE WITH 3500 COMPATIBLE WITH 3800

LUMet®

Laser-Ultrasonic Sensor for In-Situ Metallurgy Microstructure Studies

It is now possible to monitor metallic microstructures in real time, in-situ and at high temperatures while conducting physical simulations. The LUMet system provides unprecedented capabilities by allowing observation of the internal physical state of a specimen during Gleeble tests.

Researchers can gather in-situ information on:

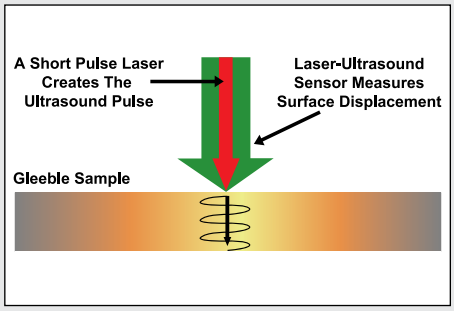
- Recrystallization
- Grain growth
- Grain size
- Phase transformations
- Elastic constants
- Texture

Laser-ultrasonics is a technology that enables non-contact ultrasonic measurements, using lasers to generate and detect ultrasound pulses. Unlike other ultrasonic technologies, it can be used on hot materials because there is no physical contact. Therefore, it is ideally suited for in-situ studies of solid metallic materials up to their melting point.

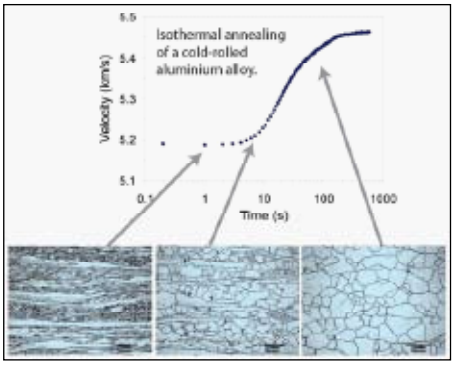
How It Works:

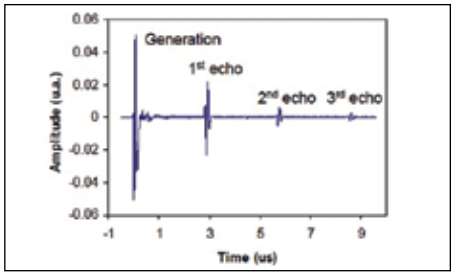
The LUMet system generates and detects ultrasound pulses in a sample under test with lasers. To generate the ultrasound pulse in the sample, a high-power, short-pulse laser produces light pulses about 10 nanoseconds in duration. Each pulse causes intense pressure on the surface of the sample, and sends an ultrasonic pressure pulse through it.

A laser interferometer measures sub-nanometer surface displacement caused by the pulse laser and its subsequent reflections as it echoes through the sample with sub-nanometer resolution. Based on the measured velocity and attenuation of sound in the medium, researchers can determine texture, modulus, grain size and phase mixtures.



In the field of metallurgy and metallurgical processing, ultrasonics is a sensitive technique for measurements of elasticity, internal microstructure, phases, crystallographic texture, grain size, and more. When used with the Gleeble 3500-GTC or 3800-GTC, these measurements can be done in-situ, in real-time, during thermomechanical processing.





Example of laser-ultrasonic measurement of a single ultrasound pulse bouncing back and forth between the two faces of an 8 mm thick steel plate at 1100°C inside a Gleeble 3500-GTC.

Days and weeks of metallurgical studies yielding a few measurements on quenched samples can often be replaced by a single in-situ laser-ultrasonic measurement yielding hundreds of measurements in real time.

Specialty Systems:
HDS-V40
Direct Rolling Simulator

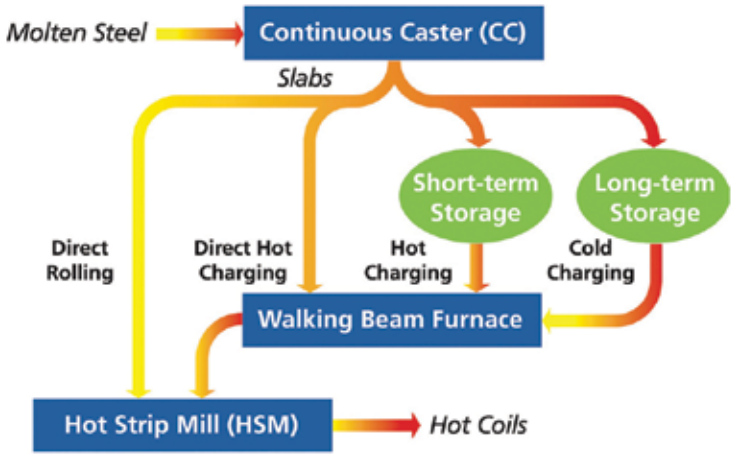
Unparalleled Technology for Process Development

Continuous casting followed by direct rolling (CC-DR) offers steel makers the opportunity for substantial energy savings and reduced capital expenditures which in turn can reduce costs & increase profits.

The HDS-V40 is the only commercially available laboratory system capable of simulating direct rolling, from the continuous caster to the end of the hot rolling process, all in one continuous sequence using a single specimen. Steel makers can explore the promise of continuous casting and direct rolling (CC-DR) on an affordable, reproducible laboratory scale. In addition to direct rolling, this system can be used for simulating semi-solid rolling (liquid metal core reduction), plane strain compression, hot rolling and forging.

Thermal and Mechanical Systems
The HDS-V40 uses direct resistance heating—developed on the world-renowned Gleeble—and expands the technology to utilize larger specimens to allow subsequent properties testing on the specimen material after deformation. An innovative melting containment system features a crucible that holds the molten material in place and can be removed prior to deformation.

Unprecedented Flexibility
No other system offers so much flexibility to perform melting, solidification and deformation simulations in so many different ways. The HDS-V40 can perform plane strain deformation and model deformation in different parts of the melt zone—in either the semi-solid material or in the previously melted and re-solidified material. Simulations can be performed in controlled atmospheres. In addition, the deformation anvils have separate heating controls so that the temperature of the anvils can be adjusted independently of the specimen. This allows the operator to simulate the temperature of the rolls as they contact the slab. An optional laser dilatometer allows collection of transformation data as the specimen cools.



The HDS-V40 can perform melting, solidification and hot deformation on a specimen in-situ in a single experiment allowing simulation of any of the above processes, from continuous caster to hot strip mill.

The HDS-V40 at a Glance

- Continuous Casting–Direct Rolling, liquid metal core reduction, hot rolling and hot forging simulations
- Direct resistance heating for high speed thermal capability and precise control
- Two 40-ton hydraulic systems with exact control of strain and strain rate
- Deformation speeds from 0.1 mm/sec - 1.7 meters/sec
- Simulations can be run in air, vacuum or inert gas
- Quench in-situ at any time during simulation
- Precise digital control system
- Large sample sizes. Standard sample size is 10 mm x 50 mm x 152.4 mm

Parts & Service System Upgrades
Training Calibrations Maintenance

Explore programs and options to maximize system performance & ensure your Gleeble continues to deliver world-class results.

Gleeble systems are powerful and highly precise scientific instruments. With proper maintenance and care, Gleebles often provide researchers with decades of reliable service. DSI's Global Service Organization is dedicated to providing customers with the support needed to keep their equipment running at peak performance.

Training: The most important part of any Gleeble Research Program is the human component. Knowledgeable, well-trained users ensure simulations are designed and executed correctly. Various levels of training are offered by DSI, including general operating instructions, advanced training, and application-specific training. Training is available at the DSI facility in New York, at user sites or at Regional Demonstration Centers around the world.

Extended Warranty: Each new Gleeble system passes extensive acceptance tests, both in the DSI factory and again at the installation site and comes with a comprehensive one (1) year warranty covering defects in materials and workmanship. The standard warranty can be extended to cover additional years via the purchase of an extended warranty. Older systems that are beyond their initial manufacture's warranty period, may be eligible for extended warranty protection – please contact us to learn more.

Annual Maintenance Contract (AMC): Like any complex instrument, Gleeble systems require periodic maintenance. AMCs are a great way to proactively ensure regular service and calibration for your equipment. By purchasing an AMC, organizations can schedule service visits during dates that are convenient for them. Regular maintenance minimizes the risk of failures and downtime. Service visits typically range from 2-3 days on-site depending the features and accessories installed on each system.

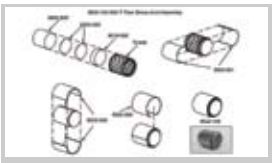
Calibrations: Gleeble systems are precise, high performance machines and should be calibrated at least once a year by a Certified Gleeble Service Engineer. The DSI Global Service organization offers calibration as a stand-alone service or as part of an Annual Maintenance Contract.

System Upgrades: A wide range of options and accessories are available to customize and add capability to your Gleeble system:

- Software and Hardware upgrades
- Integration of Digital Image Correlation technology
- Mobile Conversion Units
- LED Optical Extensometer and Dilatometer
- Gleeble Touch Control – This significant software and hardware upgrade includes a range of enhancements, including improved usability and performance.

Spares, Replacements and Consumables:


Grips


Anvils

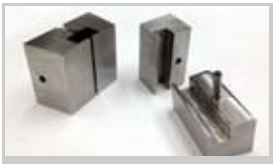

Thermocouple Wire & Welder


O-Rings & Seals


Melting Crucibles


Filters


Quartz Rods


Specialty & Custom Fixtures

GLEEBLE®

DYNAMIC SYSTEMS INC. 60 Years of Excellence 1957 2017 www.GLEEBLE.com

About Dynamic Systems Inc.

In 2017, Dynamic Systems Inc. celebrates 60 years of excellence in delivering valuable tools to the materials research and production community. Located in New York's Tech Valley, DSI has grown from humble beginnings to become an international organization with employees and partners around the globe. Gleeble systems have become the world-standard for thermal-mechanical physical simulation systems.

DSI's first system, christened the "Gleeble" by one of its creators, was originally developed to simulate the heat-affected zone of arc welding. A pneumatic system was soon added to the Gleeble, giving it limited mechanical capabilities. In 1979, the Gleeble became the first machine ever to combine full resistance heating thermal capabilities and hydraulic servo-mechanical testing performance in a single system. In the early 1980's, the machine was re-engineered to incorporate computers for controlling tests and collecting data. Since then, DSI has introduced an advanced series of systems, which combine dynamic thermal and mechanical testing utilizing sophisticated computers for control and data acquisition.

NEW YORK'S TECH VALLEY

As a result of this innovative technology, it is possible for materials to be tested in the same dynamic way that they are fabricated and used. This capability is producing new insights into materials science and new breakthroughs in productivity.

Our team is excited to celebrate our 60th anniversary and is proud to carry on the tradition of innovation and excellence that has been key to our customers and our own success. We look forward to supporting our customers and the rest of the materials research community for the next 60 years.

Gleeble Systems are Supported by DSI's Global Network of Sales, Support and Metallurgical Professionals

More Information

For ordering information, please contact us at **info@Gleeble.com** or **(518) 283-5350**

P.O. Box 1234, 323 Route 355
Poestenkill, NY 12140 USA

Visit us online at **www.Gleeble.com**

Specifications are subject to change without notice. Pictures and diagrams in all brochures and documents show latest models as of time of publication. Actual appearance may vary slightly.

SG-5/18