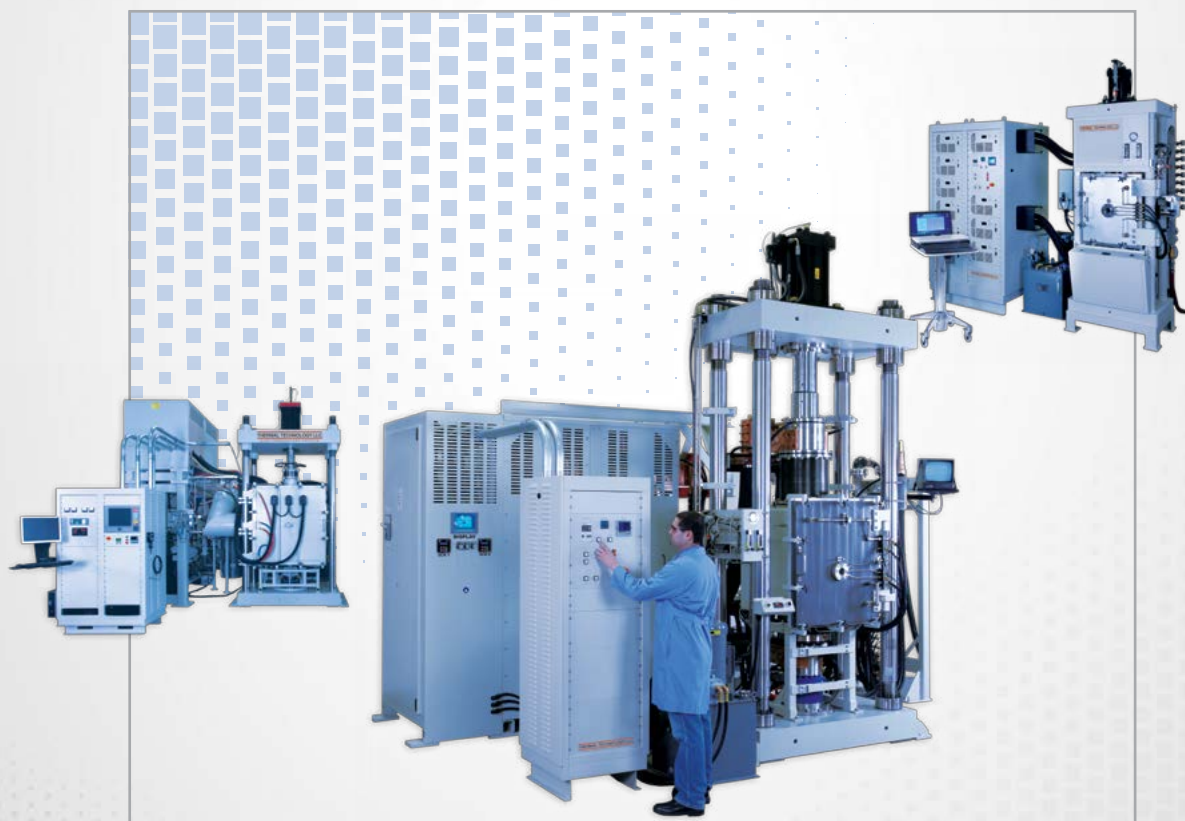


ADVANCED THERMAL PROCESSING SYSTEMS

PRESS SYSTEMS

Spark Plasma Sintering ■ Direct Current Sintering ■ Hot Press



3,000 systems installed in 40 countries
help safeguard your processing performance

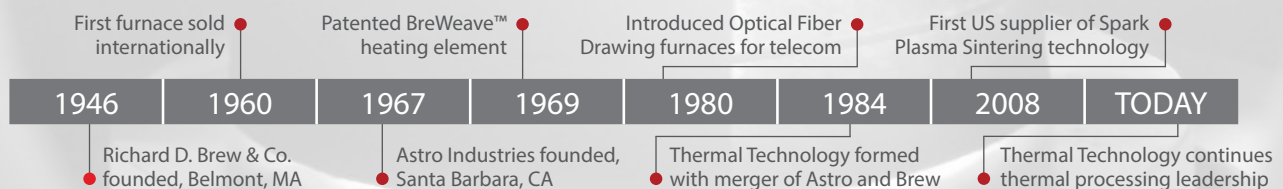


POWERFUL PRODUCTIVITY SYSTEMS FOR THE DENSIFICATION AND DIFFUSION BONDING OF METALS, CERAMICS, COMPOSITES AND NANO-STRUCTURED MATERIALS.

- > Enabling process technology for global leaders since 1946
- > An install base of over 3,000 systems in 40 countries
- > Decades of technical innovation, process knowledge, full-factory testing, installation assistance and aftermarket support
- > Markets served include lighting, electronics, healthcare, renewable energy, communications and aerospace

Pictured:
DCS 8-inch tooling at 1,800°C

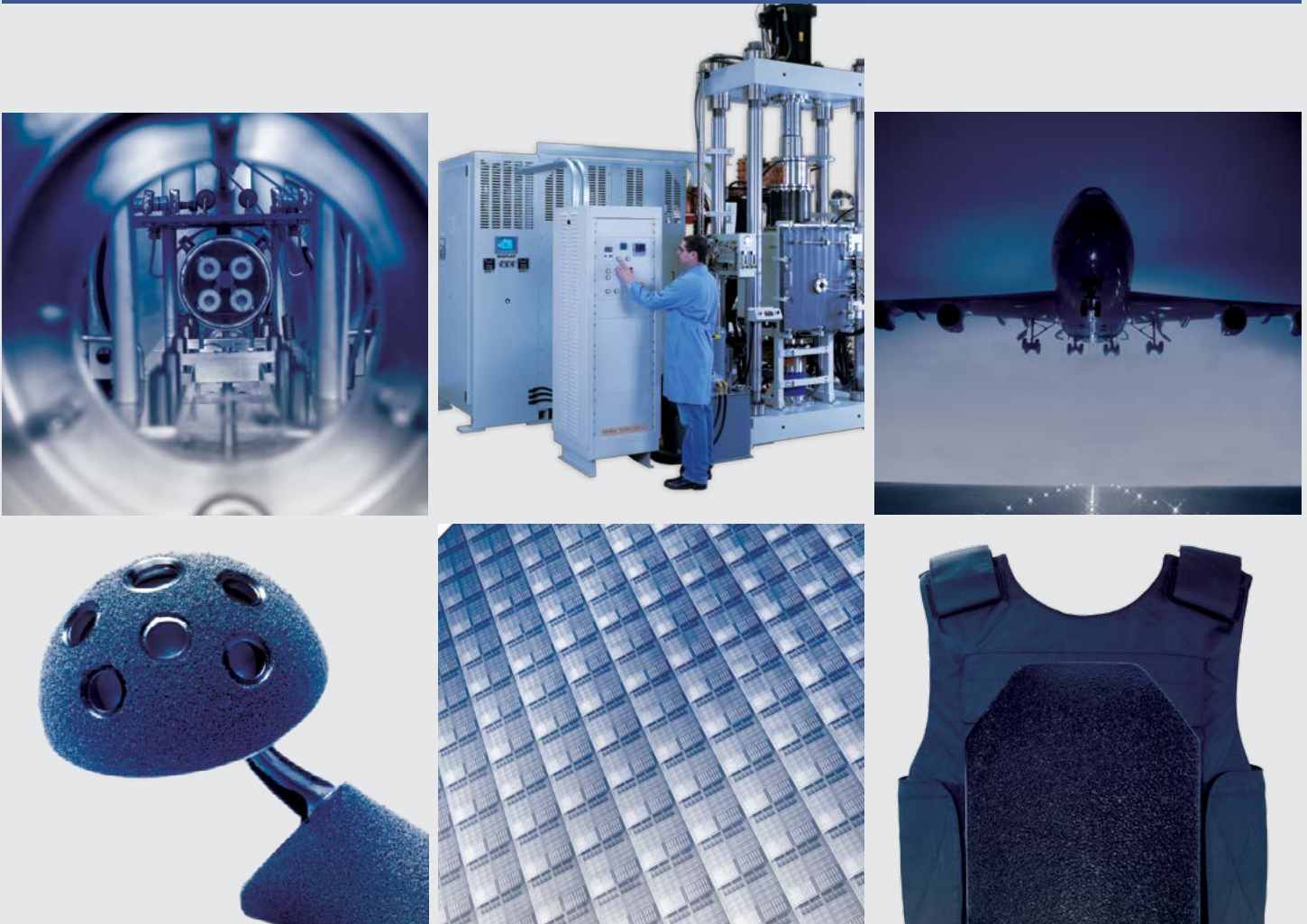
FROM INDUSTRY PIONEER TO GLOBAL INNOVATOR



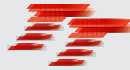
THERMAL TECHNOLOGY IS THE ONLY U.S.-BASED MANUFACTURER OF SPARK PLASMA SINTERING (SPS) SYSTEMS AND THE WORLD'S ONLY PROVIDER OF BOTH SPS AND DIRECT CURRENT SINTERING (DCS) PRESS SYSTEMS.

The use of innovative metals, ceramics and composite materials in industrial and consumer products is expected to grow in the coming years as the availability of these materials increases and their cost of manufacturing continues to come down. One critical requirement for this growth is a production proven hot press system that can deliver high volumes of materials at price points that allow design engineers to take advantage of the improved mechanical, optical and electrical performance these new advanced materials offer for use in next-generation products.

Thermal Technology is a leading provider of hot pressing systems utilized in the production of high temperature ceramics, advanced composite materials and functionally graded materials (FGMs) for use in the aerospace, semiconductor, defense, power generation, automotive, medical device and other commercial industries. Our hot press systems have been tested by the world's leading universities, top research institutes and a growing number of industrial clients in the development of innovative, next-generation products.



Applications surround a DCS 100-30 press system (clockwise): vital components for analytical instrumentation, DCS 100-30, aeronautical instrumentation components, ceramic plates for body armor, semiconductor manufacturing components, artificial hips and joints.



SPARK PLASMA SINTERING (SPS) AND DIRECT CURRENT SINTERING (DCS) SYSTEMS

Our innovative rapid powder consolidation technologies, Spark Plasma Sintering (SPS) and Direct Current Sintering (DCS) utilize high amperage DC current for quick and even thermal processing. SPS (pulsed DC current) and DCS (constant DC current) systems quickly process conductive, non-conductive and composite materials, including nano-material, to any level of density with high homogeneity at lower operating costs. Thermal Technology's modular power supplies can be configured to your specific applications.

Emerging markets for SPS and DCS systems include the development of thermoelectric generators for automotive applications. This developing green technology converts waste heat from engine exhaust and industrial plants into electricity. Other applications include fuel cell materials, high strength and wear resistant tooling, sputter targets, diamond compaction for abrasives and the development of pure or mixed metallics, ceramics or cermets where maintaining nanometric and fine microstructure is required.

SPS and DCS Systems Include:

- Remote PC-based programming station with real-time editing of waveform, force and temperature profile
- High-speed proportional valves for ultra-fine hydraulic force control
- Fully programmable modular power supply, including mid-process waveform multi-step adjustability



SPS 10-4: 10 tons force and 4,000 amps



SPS 25-10: 25 tons force and 10,000 amps



DCS 100-30: 100 tons force and 30,000 amps

TECHNOLOGICAL BENEFITS

- High speed powder densification process requiring significantly less process time and energy consumption than conventional sintering methods
- Retains nanometric and fine microstructures for superior finished material properties
- Glove box friendly design
- Produces materials with controlled and uniform porosity
- Efficient and rapid sintering for fast cycle times
- No pre-forming or binders required
- Preservation of purity due to simpler fabrication process
- Front load access

SPS AND DCS CONFIGURATIONS

Our modular power supplies can be configured to your specific applications.

Standard and custom systems are available. Please inquire for more information: sales@thermaltechnology.com.



HOT PRESS SYSTEMS

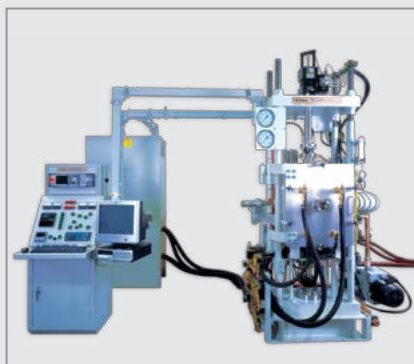
Thermal Technology's hot pressing systems are designed for simultaneous application of high temperature and high force. Primary applications include powder densification and diffusion bonding of metals, ceramics, cermets and composite materials.

Systems include:

- Graphite, tungsten, molybdenum or ceramic hot zones
- Optional interchangeable hot zone (available on certain models)
- Can be utilized as a batch furnace with addition of optional components



HP 20-4560-20: Operates at up to 2,000°C in inert or vacuum atmospheres. Has 10-ton force load frame and hydraulics. Provides 360° exposure to punch and die.



HP 50 912-25: Operates at up to 1,500°C in inert, vacuum or gas atmospheres. Has 20-ton force load frame and hydraulics. Provides 360° exposure to punch and die.



HP 200: Operates at 1,450°C with a 100-ton force load frame and hydraulics. The 24" x 24" x 30" molybdenum hot zone is capable of diffusion bonding multiple parts in one load.

TECHNOLOGICAL BENEFITS

- Robust four-column, rigid load frame
- Highly accurate force control
- Reliable powder densification and diffusion bonding
- Optimum hot zone temperature uniformity
- Low entry costs
- High level of repeatability
- Long life, low maintenance

HOT PRESS SYSTEM CONFIGURATIONS

Graphite and Refractory Metal Hot Presses				SiC Hot Presses			
MODEL	PRESS CAPACITY TONS	MAX HOT ZONE INCHES	MM	MODEL	PRESS CAPACITY TONS	MAX HOT ZONE INCHES	MM
HP 20	10	4 Ø	101.6 Ø	HP 22	10	4 Ø	101.6 Ø
HP 50	20	7 Ø	177.8 Ø	HP 52	20	7 Ø	177.8 Ø
HP 60	30	8 Ø	203.2 Ø	HP 56	25	12 Ø	304.8 Ø
HP 100	50	12 Ø	304.8 Ø				
HP 200	100	24 x 24	609.6 x 609.6				
HP 500	250	24 x 24	609.6 x 609.6				

THERMAL TECHNOLOGY THERMAL PROCESSING SYSTEMS

SPARK PLASMA SINTERING SYSTEMS

A revolutionary, high speed powder densification technology offering significant savings of time and energy and the ability to retain nano-structures.

HOT PRESS SYSTEMS

For the simultaneous application of high temperature and high pressure. Effective and efficient powder densification, diffusion bonding and processing of composite materials.

LABORATORY FURNACES

Suitable for a wide variety of laboratory and small scale production applications. These furnaces are reliable, versatile, easy to use and specific models each 3,000 °C.

DIRECT CURRENT SINTERING SYSTEMS

All the benefits of spark plasma sintering with a constant (non-pulsed) current designed for larger systems.

PRODUCTION FURNACES

Offer vacuum, inert or reducing atmospheres and automatic controls. Two, four or six-sided heating provides optimized uniformity. Effective for sintering, presintering, debinding, annealing, brazing and metallizing.

APF AND CPF SYSTEMS

Provide fully automatic, unattended operation at temperatures to 2,500°C. Parts processing is quickly cycled with rapid temperature ramp up and ramp down.

Service Commitment

Thermal Technology is dedicated to delivering the highest levels of satisfaction in the implementation of our processes and equipment. We respond to the needs of our customers with proven solutions, comprehensive training and support.

Mission Statement

Enable our customers' businesses by providing high quality thermal processing equipment solutions with outstanding support and service.

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