

SPS • P²C[®]

Think More...Make More...Test More...Quickly & Effectively

SPS • P²C-300

Direct Current Sintering System

The time proven, award winning SPS•P²C-300 plasma sintering equipment, with its superior process profiling technology, and large part capacity, can deliver next-in-class materials allowing the realization of your most challenging and dynamic materials engineering and research ideas

- **SAFETY** 1st—Auto-Shutoff over-temp protection systems monitor key components. Critical P²C-300 components are enclosed for operator safety. Current power levels, and hydraulic pressure application limits can be set and locked from unauthorized changes
 - **VERSATILITY and ACCESSIBILITY**—The basic vacuum chamber offers up to 30"x30"x36" sizing for easy die placement and retrieval—Custom sized chambers meeting unique customer requirements can be accommodated
 - **VACUUM CHAMBER**—Water cooled, 319L stainless steel vacuum chamber allows continuous operation at temperatures up to 2,500 °C. Mixed inert gas (Ar/He/N₂) monitoring and mass flow control system instrumentation is provided. Vacuum system for 10⁻³ torr provided
 - **PRESS FRAME**—Rugged P²C-300 4-POST construction allows application of up to 250 tons (0 to 2500 kN) of force; with easy electrode and vacuum chamber seal maintenance
 - **HYDRAULICS and THERMAL MONITORING**—Manual or user programmable 10,000 psig systems designed to give maximum flexibility.
 - Ram position read out having up to 0.01 mm (0.0004") precision
 - Temperature can be monitored from 0 to 2,500 °C using thermocouple and optical pyrometer system. Motion slide and video tracking pyrometer positioning systems are provided; operating (Temperature vs. Time) profiling is user programmable via industry proven controllers (Eurotherm / Watlow). Heating cycle can be on-the-fly switched from current to temperature control
- SMR or SCR POWER RECTIFIER OPTIONS**—100% duty cycle, 0 to 50,000 Amperes @ 10 or 12 Volts. The Switch Mode or Silicon Controlled Rectifiers can be either voltage or amperage controlled, with fully programmable touch screen HMI or laptop based heating and cooling ramp cycles. The power supply can be configured for straight DC, or combined DC with variable duration pulsing profiles
- SYSTEM START UP & TRAINING**—Installation and basic training will be provided onsite and will demonstrate all equipment functions, equipment operation and basic troubleshooting. Operating manual will be provided and reviewed with system operators.



US Patents: 5,989,487 | 6,001,304 | 6,183,690 B1 | 6,187,087 B1 | 6,309,591 B1 | International Patents: AU: 752326 | IN: 197635



Proudly Made



In the USA



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SPARK Plasma Sintering Equipment

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SPS•P2C-300 is a production-proven system for the development and optimization of novel engineered materials with innovative performance properties

- **Metals**—Fe, Ni, Cu, Al, Co, Re, W, Mo, Ta, Ti, Mg, NiAl, TiAl
- **Ceramics**—SiC, B₄C, ZrO₂, TiB₂, HfB₂, ZrB₂, Y₃Fe₅O₁₂, TiC, WC, Y₃Al₅O₁₂, MgB₂, CaF₂, MgF₂, MoS₂
- **Composites**—TiB₂-Al₂O₃, TiB₂-ZrO₂, TiB₂-B₄C, SiC-B₄C, WC-Co, Mo-Cu, W-Cu, C-Cu, HfC-TaC, ZrC-B₄C
- **Multilayered Materials**—Up to 5 layers of differing functional properties
- **Unconventional Structures**—Nano-Carbon and Layered Composites | Porous Materials | Joining of Dissimilar Materials

Who are we? Materials Modification Inc. (MMI) was founded in 1986—www.matmod.com

- **Dynamic applications driven Development Company within the areas of materials science**
- **Cutting-edge research and development programs for private industry and government**
- **Pioneer in the field of nanomaterials and coatings technology**
- **33 patents covering novel materials, equipment, nano applications and coatings**

Our Product—SPS•P2C-300 consolidation technology is specifically designed to unlocking the high performance promises suggested by submicron and nano-scale science and materials engineering.

- **Plasma Pressure Compaction can consolidate nano, submicron and micron particulate blends**
- **P2C equipment and processing offers significant economic and physical performance improvements over traditional hot pressed and sintered ceramics and powders.**

The Innovative Solution— **SPS•P2C-300 Leaps Beyond Conventional Hot Pressing and Sintering**

- **Predictable Uniformity**—Ability to start consolidation with nano-scale materials and end with nano crystalline grain structure
- **Greater final material purity**—No binders, No cementation/alloying agents, Low/No unprocessed reactants
- **One-Step in-situ compaction, plus rapid uniform plasma heating for maximum densification and control over grain structure**
- **Maximum theoretical densities, exclusive preprocess cleaning and out gassing of particulate surface contaminants for excellent inter-particle fusion**
- **Low-temp/high thermal energy sintering yields fast-cycle consolidation—minutes vs. hours.**

Answering Challenges of High Purity, Wear, Heat and Corrosion in Typical Commercial Applications

Unrestricted R&D engineering with submicron/nano-scale metallic, ceramic and hybrid materials, new classes of bi-metal, ceramic/metal laminations, multi-material matrix/composites

Custom Nano and Sub-Micron Sputtering Targets | Super Performance Seals and Bearings | Oil and Gas Well Drilling Components | Tube/Wire Drawing and Extrusion Die Inserts | Hot and Cold Forming Punches | Carbides for Wire EDM | Large Cutting Inserts | Brake Materials | Wire and Mandrel Tube Preforms | Water Jet Nozzles | Abrasion Resistant Parts

Broad Government and Commercial Market Segments

Metals, ceramics or hybrids designed for applications in land, sea, air and space defense, medical and industrial markets where low/no downtime are crucial considerations.

High Temperature Mirrors | IR Windows | Lightweight Body Armor Inserts | Exterior and Interior Vehicular Armor | Fixed and Rotary Wing Aircraft Cockpit Armor | General R&D and Engineering Development of Ceramic, Metallic, and Functionally Gradient Materials | Refractory Metal Substrates

US Patents: 5,989,487 | 6,001,304 | 6,183,690 B1 | 6,187,087 B1 | 6,309,591 B1 | International Patents: AU: 752326 | IN: 197635

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