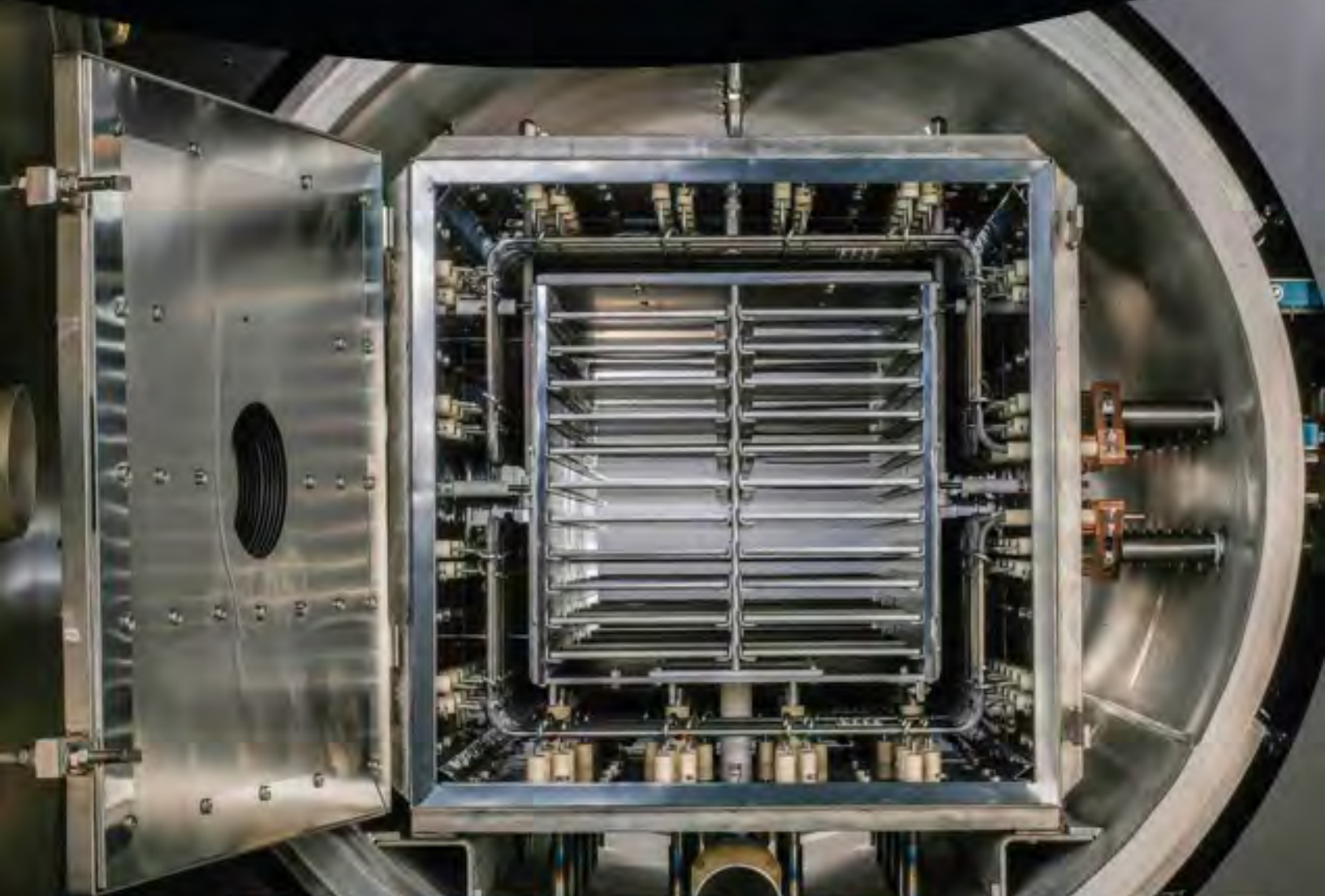




ELNIK SYSTEMS

Innovation. Experience. Excellence.



Making a world of difference in
Metal Injection Molding through
innovative technology and equipment



For Quality & Performance that Lasts, Choose The First in MIM Innovation... Elnik Systems.



It's a fact. Elnik Systems developed the **first** all refractory metal Debind and Sinter furnace in the industry. By any engineering standards, this was no small feat. Its partial pressure operation for Hydrogen, Nitrogen or Argon with laminar gas flow via internal retort resulted in consolidating the process steps of second stage debinding and sintering of MIM parts into a one step process. This shortened process time from typically 30+ hours to less than 20 hours.



And that was just the beginning. Their remarkable six zone temperature control with their proprietary **"AccuTemp"** thermocouple correction enabled Elnik furnaces to have very tight temperature modulation and uniformity increasing overall density of **MIM** parts to the highest levels yet.

METAL INJECTION MOLDING (MIM)... PLAYING A BIG ROLE IN PRODUCING SMALL PARTS

When the focus of your manufacturing needs is to produce large quantities of small complex parts, Metal Injection Molding is the answer. Fine metal powders are custom formulated with a binder (thermoplastics, waxes and other materials) into a granulated feedstock, then fed into an injection molding machine where the screws and barrel are modified in order to mold abrasive materials such as metal powders. The first stage binder of the molded green part is then extracted by a thermal, solvent or catalytic processing step. Historically, the secondary binder was typically removed in a thermal debinding furnace which also pre-sintered the parts before they were moved to a conventional sintering furnace. Elnik's introduction of a partial pressure refractory metal furnace with laminar gas flow allowed these two separate steps to be combined without moving the parts, therefore saving 15+ hours processing time. Metal injected parts can be virtually unlimited in shape and geometric-feature. Capability of high production rates are possible through multi-cavity tooling. Elnik's leadership in MIM part processing has made it the pre-eminent name in MIM technology.

THE ELNIK "SYSTEM" TAKES THE RISK OUT OF BUYING MIM TECHNOLOGY

In most cases, when you purchase a refractory furnace or other MIM equipment, you never know what its capabilities are in meeting your production demands until AFTER you've made the purchase. Often, this can mean a loss of thousands or even millions of dollars when you discover it underperforms resulting in huge amounts of defective parts. This is not the case with Elnik. Unlike its competitors, Elnik Systems offers **FREE "test" runs** in production sized MIM furnaces **BEFORE** you buy their product custom-tailored to meet your specific manufacturing requirements. The data and adjustments derived from these "test runs" will be calibrated by Elnik into the product you purchase. As a result, you are assured maximum production efficiency from the day you receive the equipment to virtually eliminate this risk after final purchase.

WE GOT OUR START IN 1969 AND THE REST IS HISTORY...

1969

Elnik Instruments was established as a wholly owned subsidiary of W.H. Joens & Co. in Germany, marketing temperature controllers, recorders and programmers for industrial furnaces, vacuum furnaces plus a variety of plastic extrusion and injection molding machinery

1982

Elnik focuses efforts on vacuum furnace systems for Raytheon Company, Waltham MA.

1986

Elnik Systems was formed to meet growing demand for custom vacuum furnaces primarily for the military industry.

1995

Elnik developed a "one-step" debind and sinter partial pressure furnace to meet the needs of the growing MIM market. The MIM 3000 furnace provides a very cost-effective alternative to the two-furnace technology being used at the time.

1999

Elnik Systems moves into a new state-of-the-art facility housing DSH Technologies, an Elnik affiliate. Elnik continues to manufacture the most advanced MIM furnaces and debinding ovens in the world for one-step debinding and sintering processes.

2004

Elnik continues innovation of its furnace capabilities, introducing "AccuTemp" Temperature control allowing each temperature zone inside its furnace to be controlled within +/- 1° of its set point. Elnik Developed a Catalytic Debind Oven to be used for processing BASF Catamold Feedstocks. This system can be used for processing any polyacetal based Feedstock

OUR PRODUCTS ARE IN A CLASS ALL THEIR OWN...

Elnik engineering and performance speaks for itself. Cutting edge technology results in time saving, cost-efficient production unmatched in the industry.

CATALYTIC DEBIND: CD 3002 and 3045

designed exclusively for catalytic debinding of BASF feedstock "Catamold"

Designed with integration in mind... A full load of trays fits exactly the same as in MIM 3000 sintering furnace; eliminating handling or restaging of parts, increasing production time. The CD 3002 and 3045 are designed with controllability of nitric acid, nitrogen, blower speed, burner and temperature. Utilizing an Excel Spreadsheet, all process parameters are entered then downloaded into the ovens PLC controller. This allows the system to function without supervision. Designed with safety in mind, the CD Oven contains automatic process steps to help eliminate left over nitric acid fumes and acid in supply lines once the process is complete. All process steps are recorded, trended and stored locally on the system. This allows the operator to recall former runs, reprint data and trends. It also offers traceability for heavily regulated industries.



SOLVENT DEBIND: SD 3045 designed exclusively for wax-based feedstocks

Fully automated closed loop front loading system operated with any non-flammable and/or flammable solvents. Parts are fully immersed in solvent re-circulated inside the chamber during debinding. After the debinding soak step, the used solvent is removed from the chamber then distilled to remove the wax so it can be reused for the next debinding cycle. Solvents which remain trapped in the parts evaporate and a vacuum is pulled in the heated chamber removing these remaining vapors which are purged through a carbon purifier preventing vapors escaping into the atmosphere. Emission amounts meet all national standards and CE requirements.

2005

Elnik added automatic cleaning features to its Vacuum Pump and Binder Traps, significantly reducing the manual maintenance time required of its systems.

2006

Elnik introduces a full line of graphite MIM furnaces, called the GraphMIM 2000, to its line for lower cost MIM processing of iron materials. This system contains all the same innovative functions as its MIM3000 series furnace.

2012

Elnik Develops a Metal and Ceramic debinding oven made for BASF metal and ceramic Catamold Feedstocks. This system has enhanced controllability of temperature, Nitric Acid flow and gas flow.



OUR PEOPLE MAKE ALL THE DIFFERENCE

The key management personnel at Elnik are what drives its success. There's no substitute for experience as you can see from their backgrounds...

CLAUS JOENS, President

founded Elnik in 1969 making/repairing temperature recording devices used on furnaces, twin screw extruders etc. Began and excelled in high temperature/high vacuum furnace business in 1980's. Entered MIM market in 1995 with introduction of first refractory 2nd stage debind and sinter furnace. Has since advanced the MIM industry process technologies and equipment capabilities.

STEFAN JOENS, Vice President

10+ years' experience at Elnik Systems manufacturing, engineering, servicing, coordinating and improving the process equipment used in the MIM industry. Trained at Fraunhofer Institute during 2011 in all metal injection molding process steps and affiliated metal part development processes.

DR. SATYA BANERJEE

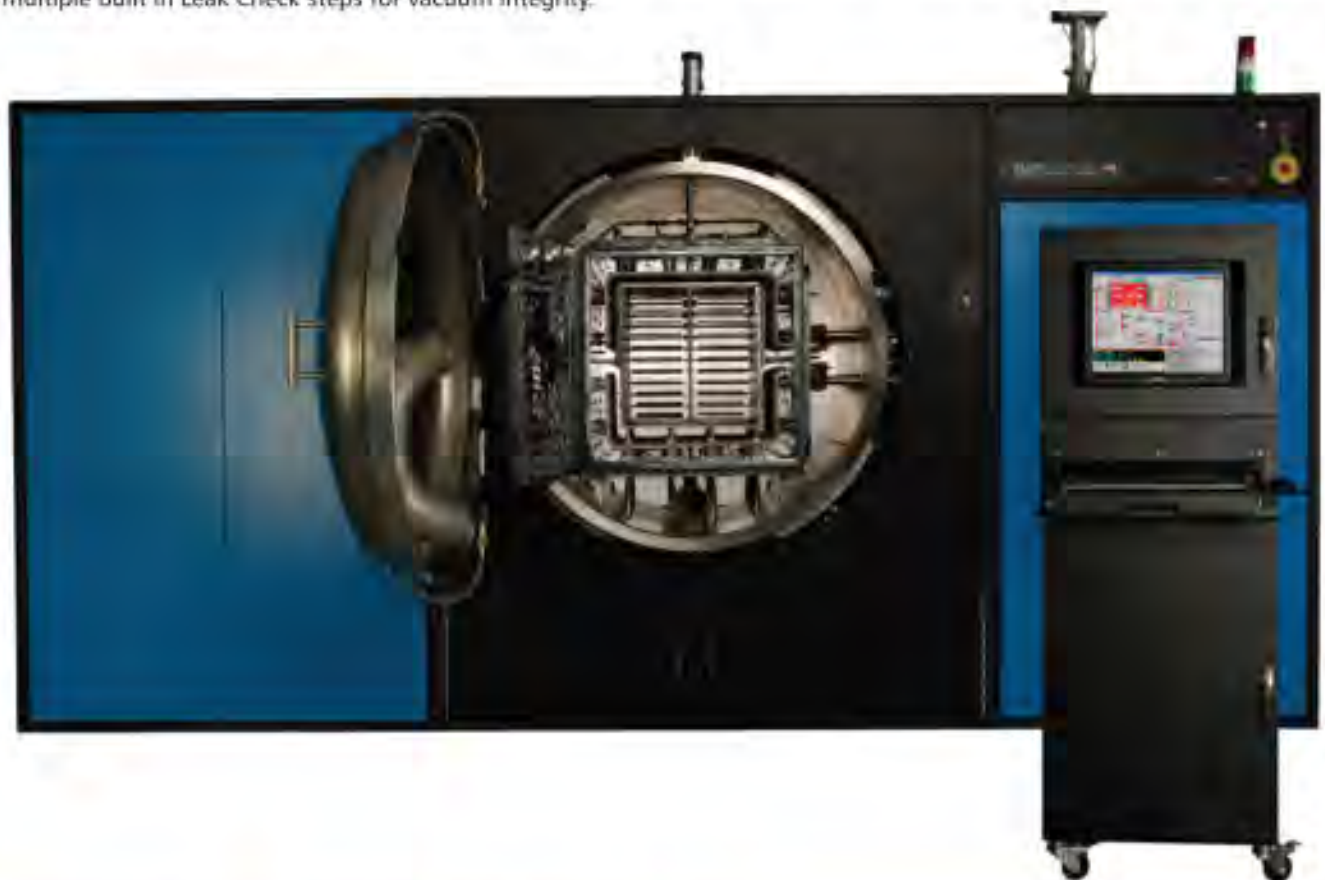
Project Manager / Chief Metallurgist
DSH Technologies

Over 30 years of US Industrial experience, more than 25 of which has been developing materials processes and products as well as setting up laboratory and production equipment in MIM industry. Knowledge in a wide array of materials from steels, Stainless Steels, ferrous/nonferrous to precious metals, superalloys and intermetallics. He is widely published and holds one US patent.

Even more important, our 30+ employees, who have been with us for many years, have continually helped to improve the design and manufacturing processes, making our MIM furnaces the most innovative production equipment for a reasonable price in the industry.

MIM 3000 Debind and Sinter Furnaces

Processes any metal with any binder in a **"ONE STEP"** debinding and sintering cycle, without restaging parts. The process is enhanced with the use of a gas tight refractory metal retort and gas management system. Partial Pressure operation resulting in a Laminar gas flow throughout the retort guarantees consistent parts every process run. Gas management system consists of mass flow controllers for retort and hot zone plus a partial pressure valve at the inlet of a specially designed & modified dry vacuum pump. Differential gas flows into the hot zone and retort guarantee only minimum binder materials will stick to the cold walls of furnace. Retort has gas plenums on each side with a calibrated hole pattern ensuring heated gas flows evenly across each shelf of retort. Proprietary **"ACCU-Temp"** Technology allows each of the 6 zones in the furnace to run $\pm 1^{\circ}\text{C}$ of temperature set-point. Wire and Lot certified thermocouples with different calibration points enable the user to achieve higher density of MIM materials by programming sintering temperatures closer to the actual melting temperature or its solidus temperature, without the risk of overheating causing distortion of parts. The **MIM3000** series furnace is designed for fully Automatic Operation. A user friendly Excel Spreadsheet Recipe builder allows for programming of gas flow, temperature ramp and hold, partial pressure and cooling events, as well as a number of other furnace functions. Once complete and downloaded into the furnace PLC, the furnace will complete the entire process without supervision. Service or Maintenance screens remind the operator of critical maintenance steps such as pump service, thermocouples needing replacement, cleaning steps, etc... System contains multiple built in Leak Check steps for vacuum integrity.



GRAPHMIM 2000 DEBIND AND SINTER FURNACE

Processes any iron based metal with any binder in **"ONE STEP"** debinding and sintering cycle, without restaging parts. Parts are processed in a Graphite hot zone and retort. This retort is designed with similar principles of Elnik's **MIM 3000** series, where the walls utilize a calibrated hole pattern to ensure even gas flow across each shelf. Elnik's Graphite furnace line, utilizes all the same automation, temperature control, gas management, leak checking and service reminders as in its **MIM 3000** series furnaces.

Advantages of Elnik's MIM Furnaces

MIM 3000 BATCH FURNACE

- Process ANY metal with ANY binder
- Process in nitrogen, argon, hydrogen or forming gas
- Process in atmospheric pressure to partial pressure to high vacuum
- Program any control parameter in any segment during debinding and sintering
- Use less process gas, electricity, handling time, and floor space



GRAPHMIM 2000 BATCH FURNACE

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- Process in nitrogen or forming gas
- Process in atmospheric pressure to partial pressure
- Program any control parameter in any segment during debinding and sintering
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Furnace Model	Usable Retort Size Based on Shelf Width and Depth	Usable Volume (Liters)	Number of Shelves Size: (mm) - Inch	Total Load Area	Pump Speed
MIM 3001 T-50	280 x 305 x 305 mm	25	7	0.60 m ²	85 m ³ /h
	11 x 11 x 12 inch		(283 x 305) - 11.13 x 12	924 Sq In	50 CFM
MIM 3002 T-50	280 x 305 x 610 mm	51	14	1.19 m ²	85 m ³ /h
	11 x 11 x 24 inch		(283 x 305) - 11.13 x 12	1,848 Sq In	50 CFM
MIM 3045 T-50	420 x 460 x 610 mm	116	44	2.73 m ²	85 m ³ /h
	16.5 x 18 x 24 inch		(207 x 305) - 8.13 x 12	4,224 Sq In	50 CFM
MIM 3675 T-115	420 x 460 x 915 mm	176	66	4.09 m ²	195 m ³ /h
	16.5 x 18 x 36 inch		(207 x 305) - 8.13 x 12	6,336 Sq In	115 CFM
MIM 3009 T-115	420 x 460 x 1220 mm	234	88	5.45 m ²	195 m ³ /h
	16.5 x 18 x 48 inch		(207 x 305) - 8.13 x 12	8,448 Sq In	115 CFM
MIM 3012 T-115	420 x 460 x 1524 mm	292	110	6.81 m ²	195 m ³ /h
	16.5 x 18 x 60 inch		(207 x 305) - 8.13 x 12	10,560 Sq In	115 CFM
GraphMIM 2002 G-50	292 x 305 x 610 mm	54	10	0.93 m ²	85 m ³ /h
	11.5 x 12 x 24 inch		(254 x 305) - 10 x 12	1,440 Sq In	50 CFM
GraphMIM 2045 G-50	395 x 460 x 610 mm	110	40	2.40 m ²	85 m ³ /h
	15.5 x 18 x 24 inch		(197 x 305) - 7.75 x 12	3,720 Sq In	50 CFM
GraphMIM 2009 G-115	394 x 460 x 1220 mm	220	80	4.80 m ²	195 m ³ /h
	15.5 x 18 x 48 inch		(197 x 305) - 7.75 x 12	7,440 Sq In	115 CFM

Innovative System Features

- ▶ **AccuTemp** proprietary TC control resulting in tight temperature control (+/- 1°C of set-point temperature in all six control zones)
- ▶ **Automatic Cleaning Features** of binder trapping components and Dry Vacuum Pump
- ▶ **Gas Tight Retort Design** Superior gas control throughout process zone and eliminates "escaping" gas as compared to competitive designs.
- ▶ **Simple and easy to use** computer controls via Excel Spreadsheet
- ▶ **Ability to Trend** virtually all critical components
- ▶ **Service and Utilities** maintenance screens
- ▶ **Manual Leak Check** functions
- ▶ **Laminar Gas Flow** efficient, effective gas management for debinding and sintering
- ▶ **Field Service Capability On a Global Level** Elnik's Field Service team will deliver prompt, expert service to keep your process running smoothly.
 - **Annual Service**, Preventive Maintenance contracts and training
 - **Onsite repair**, installation, evaluation and support
 - **Major upgrades** or refurbishments
 - **Machine Inspection and Evaluation**
 - **Furnace Relocations**
 - **Computer Upgrades**
 - **Spare Parts Orders**
- ▶ **Virtual Connectivity** Elnik's Field Service team utilizes virtual remote connectivity to provide intelligent, quick support and troubleshooting. No matter where you are or we are in the world, we have the ability to help diagnose any issues you may have.

FURNACE OPTIONS

Diffusion pumps with rotary vane fore pumps, water cooled baffles to reduce back streaming, and appropriate high vacuum valve. This option is added when looking to achieve vacuum levels inside the chamber of 10^{-6} "

Heat exchanger with (3,000 CFM) 5,097 m³/h blower, magnetically sealed rotary feedthrough, external motor and internal shutters, computer adjustable pressure and temperature set point to activate blower.

Set of 12 plug in flexible survey thermocouples, Type K, with Inconel Sheath, computer integration, readout and data acquisition. Usable to 1,250 degree C (2,282 degree F).

Gas fired afterburner with integrated hydrogen igniters mounted on top of the furnace.

Control Document Reporting for heavily regulated industries. This feature provides all critical information regarding furnace run ie: Operators name, time since last service, alarms during run, total utilities used, etc... Report can be used in conjunction or as replacement of existing document for heavily regulated industries like Aerospace, Automotive and Medical.

DSH Technologies, LLC...

When we put our "knows" in your MIM business, you'll **save a fortune** in money and time!



No other MIM furnace manufacturer can offer you the Know-How of DSH Technologies. **Elnik is the only company** in its category with their own separate MIM laboratory with full sized production equipment. DSH provides comprehensive metallurgical assistance and turnkey production services to both current clients and new prospects. In short, partnering with DSH will help you avoid countless pitfalls that can unexpectedly arise in the MIM parts manufacturing process...

and we do it in many different ways:

Try Before You Buy MIM parts processing runs. DSH offers **free trial runs** of MIM parts processing to prove our debinding and sintering equipment delivers the quality and performance you need before you purchase.

Consulting DSH has helped clients set up complete MIM manufacturing companies with all required equipment from feedstock preparation to debinding sintering and all necessary lab tools.

R&D Work DSH partners with existing or new potential customers involved in processing parts or materials including medical, aerospace and automotive high temperature materials.

Toll debind and sintering services DSH can provide its customers, Elnik customers or any MIM parts producers with the option to rent DSH equipment by lot or contract for short term requirements or the occasional overcapacity run. In addition, new companies just entering the MIM industry will have DSH run their parts until their own production volume justifies the purchase of MIM equipment or while they wait for their furnace to be manufactured.

Partnering DSH also partners with companies who want to establish turnkey solutions for all aspects of the MIM parts producing process.

At the helm of DSH Technologies is **Dr. Satya Banerjee**. With over 30 years of US industrial experience, Dr Banerjee has had in-depth experience developing materials, processes and products for the **MIM industry**. His leadership in this industry has made DSH a vital and irreplaceable arm of **Elnik Systems**.



Worldwide Customer Locations



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