

# Microwave and Process Technologies



For more than two decades Y-12 has been developing microwave metal and ceramic processing technologies related to melting, casting, heat treating, sintering and bonding. Recent developments include vast improvements in ceramic systems that provide ways to heat materials not readily amenable to microwave processing.

With one basic system, it is possible to melt, cast and heat-treat. Because some metals cast with microwaves do not produce an alpha case, resulting parts can be used with minimal post-processing. Microwave-assisted chemical synthesis also is possible and is routinely used to process difficult or sensitive chemical compounds.

MATERIALS PROCESSING AND MACHINING

## Features & Benefits

- Safe — Heating is limited to specified area, increasing worker safety
- Clean — Heating creates no solid residues
- Versatile — Methods can heat disparate materials simultaneously, creating products having qualities superior to those of individual components
- Economical — Higher throughput and improved energy efficiency result in reduced manufacturing costs

- Microwave assisted chemistry (MAC) — allows the manufacture of chemicals, cross-linking of polymers and catalysis of reactions (some of which are possible only by MAC)
- Plasma creation/containment — controls location of created plasma so that it remains in proper zone for nanotechnology and other materials-processing applications

## Applications

- Casting — produces high-quality metal with few inclusions and contamination
- Annealing and heat-treating — has results comparable to those of other heat-treating methods
- Sintering, bonding and assembly — joins adjacent porous components having different strengths, electrical-/heat-transfer properties or coefficients of thermal expansion
- Fluidized bed — occurs in microwave-heated bed, resulting in quick, uniform heating and exceptional thermal conductivity

## Patents & Awards

- U.S. Patent Nos. 6,554,924; 6,562,418; 7,011,136; 7,161,126; 7,358,469; 7,601,294; 7,603,963; 7,621,672; 7,622,189; 7,767,943; 7,857,193; 7,909,907; 7,939,787; 8,028,654; 8,061,580; 8,701,970; 8,183,507; and 8,716,637

## Developers

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## Technology Readiness Level (1–9)



Actual prototype demonstration in an operational environment.

## Partnering Opportunities

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Y-12 is seeking an industry partner to fully commercialize these technologies.

**If you would like more information, please contact the  
Office of Technology Commercialization and Partnerships:**

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