

Microwave Sintering, Bonding and Assembly of Metal and Ceramic Parts



MATERIALS PROCESSING AND MACHINING



Replica of Civil War-era USS Monitor propeller illustrating phases of sintering and bonding:

Hub and four propeller blades were printed from powdered metal and sintered. Hub and top-left/bottom-right blades were assembled and then infiltrated/bonded with nickel bronze. Bottom-right propeller was hand-finished and polished. Two remaining sintered blades were positioned for subpart comparison.

Microwave Sintering, Bonding and Assembly is a manufacturing technology that creates complex metal and cermet composite components using minimal equipment. Employing either powder-printing or powder-pressing processes, parts are made and sintered to approximately 60% density. These parts are assembled, and the resulting assembly is infiltrated with molten metal to bond the parts and create a solid metal/cermet or cermet/cermet composite component.

Features

- Versatile — Subparts can have different physical/chemical/material properties.
- Flexible — Designer can incorporate in subparts blind voids, complex bends/tubes/traces.
- Simple — Manufacturer needs only a few small pieces of equipment, computer design files and a selection of raw materials.

Benefits

- Decreased manufacturing time and expense —Cutting, grinding and wear surfaces can be incorporated into components.
- Minimal post-process machining — Complex component is ready for use once assembled.
- Nearly limitless possible combinations of mechanical and thermal properties — Components can be designed to meet specific strength and temperature requirements.
- Decreased need to warehouse critical components — Assemblies can be created quickly and as needed.
- Reduced costs — Prototyping and field verification of design concepts are accomplished with minimal investment.

Applications

- Armor and ballistic protection systems
- Fins and nosecones for supersonic projectiles (leading edges)
- Propulsors
- Multi-material part manufacturing
- Prototyping
- Engine blocks

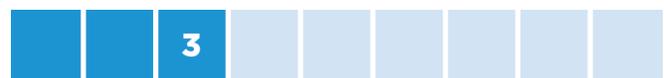
Patents & Awards

- U.S. Patent Nos. 7,857,193, 8,061,580, and 8,701,970

Developer

Edward R. Ripley

Technology Readiness Level (1–9)



Analytical and experimental critical function and/or characteristic proof of concept.

Partnering Opportunities

Y-12 is seeking an industry partner to fully commercialize this technology.

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

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