

Commercial scale microwave processing is now a reality.



It's here. Microwave technology can now be beneficially utilized for advanced material processing on a commercial scale. Trust Harper's years of industry leadership for the careful design of microwave equipment based on your material's unique properties to yield a superior product.

Is Microwave a fit?

Overcome the challenges of conventional heating

Let Harper be your guide to discover if your advanced material is suitable for microwave heating. Our capabilities cover a range of applications such as drying, sintering, activation, controlled pyrolysis, oxidation, and carbonization for products such as ceramic powders, shaped ceramics, carbon materials, and battery materials.

Through our decades of furnace design experience, our team understands the many challenges associated with conventional heating. In some applications, it can be difficult to get convective heat deep in a powder bed, control contamination for abrasive powders, or remove moisture through the entirety of the product. Microwave heating can be a solution in these and many other scenarios.

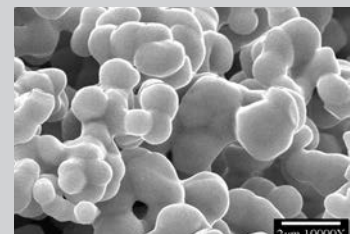
There can be many misconceptions when microwave heating is considered during the design process. Microwaves can only heat from the inside out? Microwave furnaces are only for batch processing? Harper can help determine if your material is the right fit for design of a continuous system to optimize your process.

Benefits of Microwave Heating

Trust Harper's expertise to optimize your furnace design

Microwave heating provides significant benefits in certain applications over conventional heating. As the material to be processed is the heating element, the response to the microwave energy input depends on the properties of the material. Harper can assist in finding the right system design to take advantage of microwave benefits, such as:

- Energy Efficiency - only the product is heated, reducing operating costs
- Rapid Processing - load heated directly
- Flexibility - ability to process in different environments
- Material Purity - product contamination can be dramatically reduced
- Increased Volumetric Utilization - avoids limitations of thermal conductivity, shadowing, convective heat transfer
- Smaller Footprint - little or no cooling or insulation required
- Control over Moisture Content - coupling with water is very effective
- Volumetric Heating - Little or no gradient from the outside to interior



Your Microwave Design Team

Get access to patented technology for your application

Harper has teamed up with Ferrite Microwave Technologies, LLC (FMT), the premier global provider of 915 MHz industrial microwave systems, to bring you designs incorporating their patented microwave technologies that enable advanced microwave field distribution across a wide variety of materials.

Ferrite was founded out of the Raytheon SMDO group in 1983 and has continued to innovate new technologies in both the high power microwave device field and in the industrial realm while improving efficiencies and pioneering new applications. The combination of Harper's furnace design expertise and Ferrite's technology ensuring proper distribution and control of energy means an optimized system for you.

Your Path to Scale Up

Go to market faster and more efficiently

Harper's in-house microwave testing as part of our Ignite® program can help accelerate your development timeline. Testing on a small batch scale enables the development of the proper processing conditions and for defining suitable materials of construction. It is often the case that the properties of the material being tested can change as a function of temperature and time. Small tests enable proper equipment design to deal with these changes. Harper's laboratory team is available to support testing for a wide range of applications and materials. Testing can be performed at Harper in small batches to small scale continuous processes in rotary calciners or vertical processing reactors. Our lab scale apparatus is capable of delivering up to 3kW of microwave energy and can be controlled in steps of 50W. The frequency of the radiation is 2450MHz.



Commercial Scale Microwave for Drying

The current aluminum container designed as a single mode applicator can reach very high temperatures. If a controlled atmosphere is required, a quartz reactor can be placed with quartz tubes extending through the holes of the applicator. Connecting gas sources to the quartz enables atmosphere control. All non-metallic and electrically non-conducting materials can be designed for testing in temperatures ranging from 600°-1800°C.

Additionally, Harper has teamed up with Ferrite to provide access to batch and continuous systems for testing powered by 75kW generators operating at 915 MHz. These units are larger than the lab scale apparatus and are ideal for developing processes for commercial scale operations.

With over 30 years of experience with Microwave systems, you can trust the Harper/Ferrite team of engineers to take your unique process from the lab to full commercialization.

