Microline™ Research Systems

The first and only choice in Carbon Fiber research.

Thermo. Dynamic.™

Harper International is a global leader in complete thermal processing solutions and technical services essential for the production of advanced materials. From concept to commercialization, from research scale to full production line operations, Harper is perpetually on the cutting edge. For decades, we have pioneered some of the world's most innovative, customized systems, with a focus on processing materials at high temperatures and in non-ambient atmospheres.

Harper's philosophy is not only to deliver comprehensive systems with the latest technologies, resulting in distinctive solutions, but also to design features that ensure the most efficient and effective operations to support our customer's growth. Whether it's optimized waste gas treatment, control systems with predictive maintenance, or energy efficiency techniques, Harper always has the complete solution in mind.

Of course, saying we're the partner for you doesn't get the job done — we're eager to prove it.

"Taking core technology designs and catering them to our customer's special and unique thermal processes. That's where we really shine."

– Peter Witting Ph.D.
Senior Process Technology Engineer

"At Harper, it's about stretching our horizons, taking bigger risks in bigger markets, and that's pretty unique. The beauty of it has been sustained over decades and there's a lot to be said for that."

– Ron Vacek
Director of Project Management

Harper International

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Harper International

Microline™
Big scale thinking.

Harper's fully integrated and extensively outfitted Microline™ systems are configured for customization, precision and advanced performance equal to our world-leading production lines, but in a modest scale for research and development customers. The system can accommodate line speeds ranging from 0.1 m/min to over 1 m/min and tows from 10 filaments to 48000 filaments, using minimal material to deliver maximum results.

Most lab-scale testing is performed in discontinuous batch processing steps; the Harper system provides continuous conversion of filamentary material. This revolutionary system is equally suited for and proven with both potential industry clients as well as national and academic research institutes. Unlike any other provider, Harper offers one of these academic installations as a capabilities demonstration and testing facility for clients.

Our expertise includes small scale systems of approximately 100 kg / year, best suited for mono-filament (few filament) operations and rapid cycle formulation research. Harper also offers large scale systems mini-production of material trials in composites, typically at approximately 1.5 TPY / year.

Harper systems allow for maximum manipulation of key process parameters, including controlling tension after each unit operation and multiple zones of temperature control in oxidation, pre-carbonization and carbonization to support research data needs. Our drive systems are designed for precision control of the forces imparted to the fiber, allowing for flexibility in tow counting, loading, and drive position. This flexibility yields greater customization of oxidation, with adjustability zone by zone, pass by pass, and carbonization.

Harper's Microline™ system includes these highly customizable operations:

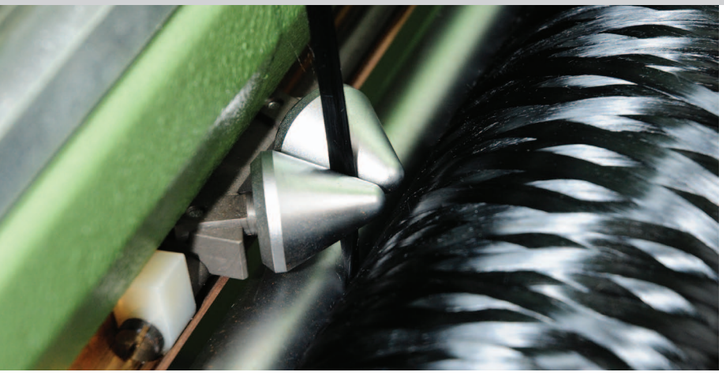
- LT & HT Pre-carbonization & Carbonization Furnaces: Up to 1000°C / 1600°, with multiple zones of control
- Creel: Up to (8) positions
- Integrated Control Systems
- Optional Sizing System
- Optional Pretreatment System
- Advanced Oxidation Oven: Up to 300°C with multiple zones of control
- Drive Stands: Multiple locations throughout the system
- Optional UHT Furnace for Carbonization: Up to 2800° C
- Optional Surface Treatment System

For advanced technical configuration considerations, the system can also be designed with these enhancements:

- Configuration of control system for preferences regarding remote access and data historian
- Material handling for emerging precursors including those requiring belt transport
- Advanced HT furnace designs for up to 1800°C
- Single or multiple dip systems for surface treatment

Start-up for Harper equipment from ambient conditions takes 8 – 12 hours, faster than most systems to bring up to temperature and stabilize. Shut down can occur in an even shorter time frame. To optimize the life of the equipment and minimize thermal cycling, we recommend that the LT and HT furnaces be idled at temperature for short downtime durations (i.e. over a weekend). This also optimizes power, when considering the requirements for heat-up.

As always, Harper offers customized training, service and maintenance options based on the needs of the client with our Pulse Program. Beyond training, Harper's proven commitment to ongoing and rapid response to keep the client and their operations running smoothly and meet evolving and emerging system requirements is a cornerstone of our success.



Clients trust their critical research programs to Harper, the pioneer of the Microline™ concept. Based on the flexibility to modify for the needs of advanced fiber processing research, no other system offers the same precision, reliability and innovative technology toolset.