American Welding Society®

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2019 AEROSPACE JOINING CONFERENCE

EDISON JOINING TECHNOLOGY CENTER TOUR

September 25

1:00 PM – 4:00 PM

1248 Arthur E. Adams Dr.

Columbus, OH 43221

The Ohio State University
College of Engineering

EWI
We Manufacture Innovation

THE OHIO STATE UNIVERSITY
COLLEGE OF ENGINEERING

EWI
We Manufacture Innovation

Edison Joining Technology Center (EJTC)

1248 Arthur E. Adams Drive
Columbus, OH 43221

This 136,000 sq. ft. center is located on the west side of campus and hosts The Ohio State University's Welding Engineering program, part of the Department of Materials Science and Engineering and the EWI corporate headquarters and laboratory. The OSU portion of the center houses faculty offices, classrooms, laboratories and is home to the Manufacturing and Materials Joining Innovation Center (Ma^2JIC). The EWI portion of the building includes offices, client meeting rooms, full-sized laboratories and a state-of-the-art high bay, all of which houses $20 million in capital equipment covering a broad range of materials joining and additive manufacturing technologies.

Ohio State's Welding Engineering (WE) program is closely allied to the study of Materials Science and Engineering (MSE). Students study and apply the technology behind efficiently joining conventional and advanced materials by exploring the complex intersection of plasma and solid-state physics, materials science, mechanical engineering, and materials processing, and real-world applications. Our graduates pursue careers in a wide range of work environments such as resistance welding of advanced high-strength steels for transportation and marine applications, adhesive bonding for advanced aerospace applications, micrometric wire bonding within electronics, medical device applications, and much more.

Ohio State's Welding Engineering Program by the numbers:

WE Faculty Members: 11

Number of female faculty in the WE program 2

Current UG students in the WE program (spring 2019 semester)..... 169

Incoming students in the WE program are females..... 20%

Students in the WE program identify as black or African American (up from 1%-3% over past five years) 6%

Incoming students to the WE program who are first generation college attendees (Spring 2019 semester)..... 13

Edison Joining Technology Center Tour

Ma²JIC

Ma²JIC is an Industry-University Cooperative Research Center (IUCRC) that promotes the development and application of fundamental knowledge in the areas of materials joining and additive manufacturing while providing a platform for the education of the next generation of scientists and engineers.

Antonio Ramirez, WE Professor at Ohio State, is the Center Director.

Other Ma²JIC sites around in North America:

- LeHigh University
- Colorado School of Mines
- University of Tennessee, Knoxville
- University of Waterloo

ma2jic.osu.edu

About EWI

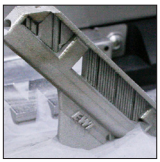
EWI empowers industry leaders to overcome complex manufacturing challenges and integrate new processes to bring products to market more quickly and efficiently. Since 1984, EWI's comprehensive engineering services have helped companies identify, develop, and implement the best options for their specific applications. Our customers include but are not limited to aerospace, automotive, consumer electronics, industrial products, defense, and heavy equipment. Backed by unmatched professional expertise, state-of-the-art lab facilities, and technology resources, we offer customized solutions that deliver game-changing results. Visit *ewi.org* or call 614.688.5000 to learn more.

EWI®
We Manufacture Innovation

by the numbers

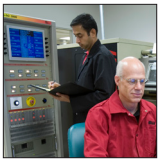
Total employees:	150
Annual research:	$27 million
Corporate laboratories:	3 (Ohio, New York, Colorado)
State-of-the-art equipment throughout laboratories	$40 million

Points of interest during the tour of EJTC:



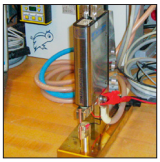
ADDITIVE MANUFACTURING

EWI offers extensive services in AM innovation, including material and process development, tooling and equipment development, in-process sensing and monitoring, post-process inspection, and material database development. With fully equipped labs across three EWI facilities, we possess a wide range of additive technologies, powder and surface characterization capabilities, metallurgical characterization, mechanical testing and NDE expertise, as well as powder production, X-ray computed tomography, and large-scale deposition work space.



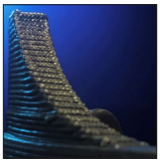
GLEEBLE

The Gleeble room houses two machines designed to measure the effects of heat on a material. When joining materials together, often much heat is used. We need to know the effects of this heat on the weld itself, as well as the material close to the process, which we call the Heat Affected Zone.



FRICTION STIR WELDING

The AccuStir™ Friction Stir machine was custom built to EWI's specifications and is one of the largest friction stir welding machines in the world. The floor below the machine has to be reinforced 6 ft deep to accommodate this machine.

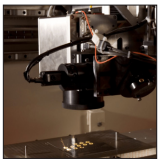


ARC-BASED DED

A cutting-edge EWI capability, directed energy deposition (DED) is a type of additive manufacturing utilizing a robotic arm, lasers and either powder or wire for complex metal builds. For many applications, DED can be faster than other methods of additive manufacturing, and its accuracy reduces the need for machining after an additive part has been produced. At EWI, we can utilize CAD-to-path (robotic path planning) to build at multiple angles. This allows us to not only build solutions for new applications but also to use DED for making repairs and adjusting features.

ULTRASONIC ADDITIVE MANUFACTURING

Ultrasonic Additive Manufacturing (UAM) is an additive manufacturing technique based on the ultrasonic welding of metal foils and CNC contour milling. High-frequency (typically 20,000 hertz) ultrasonic vibrations are locally applied to metal foil materials, held together under pressure, to create a solid-state weld. CNC contour milling is then used to create the required shape for the given layer. Successive layers are welded together to build up height. This process is then repeated until a solid component has been created or a feature repaired/added to a component. UAM can join dissimilar metal material of different thicknesses and allows the embedment of fiber materials at relatively low temperature, (typically less than 50% of the metal matrix melting temperature), into solid metal matrices. The solid-state nature of the process allows welding of dissimilar metals without forming intermetallics common in fusion based welding processes.



LASER TECHNOLOGIES

These processes are the basis of the majority of EWI's laser-related work: laser welding – autogenous and filler material, laser additive manufacturing, directed energy deposition (DED) – powder and wire, laser powder bed fusion, laser coating removal, including paint stripping, laser surface modification, laser cladding, laser heat treating, weld joint and fixture design, and advanced laser optics design.
