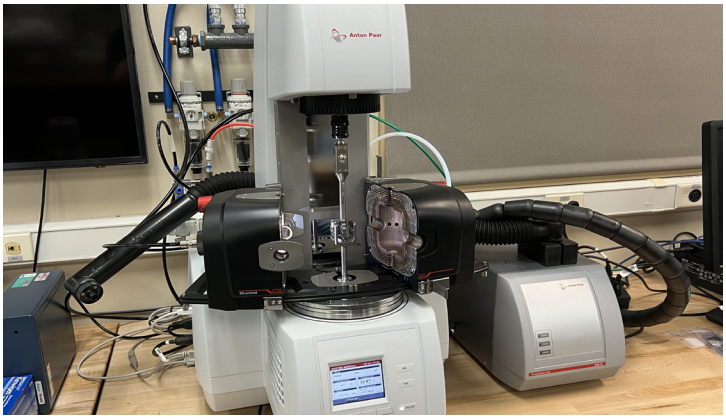
TESTING & LAB SERVICES

EWI Polymers Lab

CHARACTERIZATION AND TESTING SERVICES

EWI has expertise in thermoplastics, thermosets (adhesives and rubbers), carbon-based materials, and polymer-based composites. Our team offers manufacturing expertise at every stage of the product design cycle – *innovation, material selection, design, joining, testing, and qualification* – to help de-risk product development, ensure a successful launch, and field a durable product.

Characterizing materials and examining processes early in the design cycle of a product can save time and money. EWI applies fundamental knowledge of polymer strengths and weaknesses to downselect the most suitable product materials. Physical, mechanical, thermal, chemical, time-dependent, degradation, and processing factors are taken into consideration to mitigate the risk of product failure and lead to the creation of robust products in a competitive, constantly shifting marketplace.



Capabilities

The EWI Polymer Lab performs quality assessment and failure analysis for issues related to products in development and in the market.

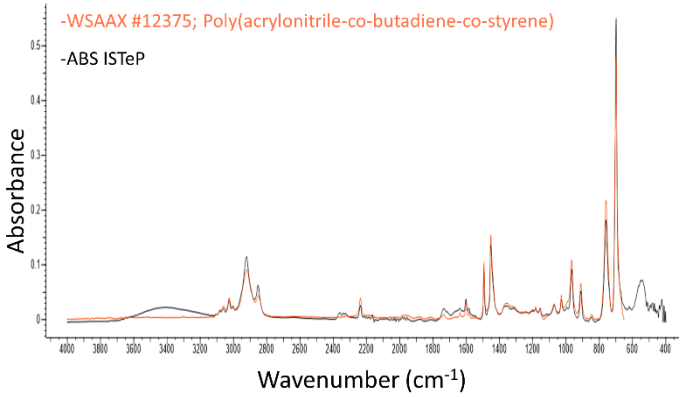
Our services include:

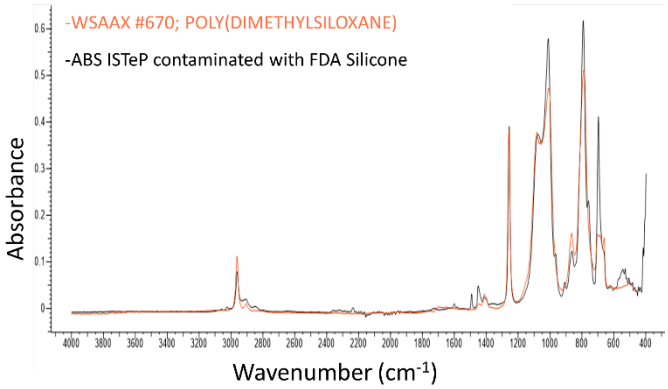
- *Fourier Transform Infrared Spectroscopy (FTIR)*
- *Dynamic Mechanical Analysis (DMA)*
- *Rheology of Polymer Melts*
- *Differential Scanning Calorimetry (DSC)*
- *Thermogravimetric Analysis (TGA)*
- *Microscopy*
- *Leak Testing*
- *Mechanical Testing*
- *Accelerated Aging*

EWI®
We Manufacture Innovation

For more information regarding our capabilities and services, visit WWW.EWI.ORG →

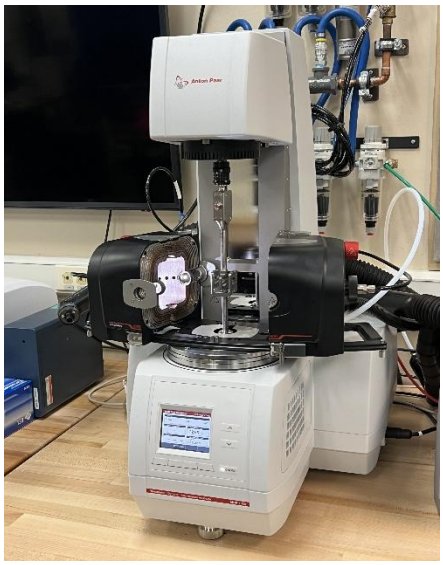
Fourier Transform Infrared Spectroscopy (FTIR)

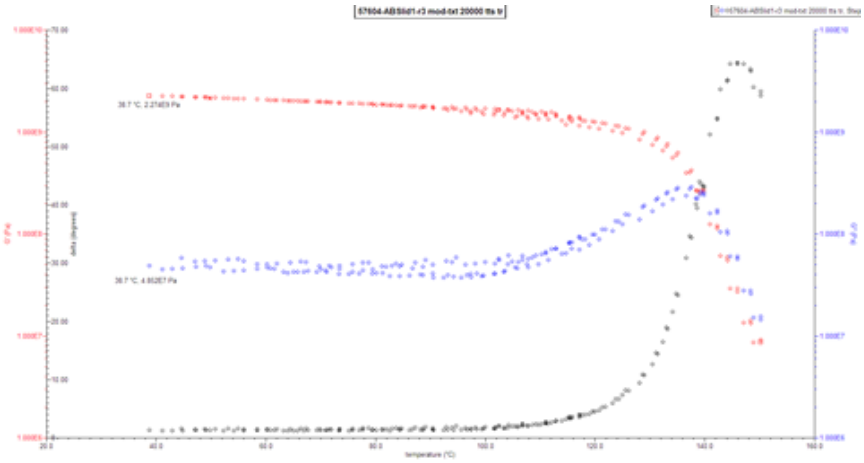




Name	Reference	Description
Organic material Identification	ASTM E1252	Reflective, transmissive, or attenuated total reflection (ATR) is used to identify a material.
Surface Contamination Evaluation	ASTM E1252	ATR is used to determine whether a surface is contaminated, and potentially, to identify the contaminant.

Dynamic Mechanical Analysis (DMA) and Rheology





Name	Reference	Description
Characterization of Material Mechanical Properties	ASTM D4065, D4440, D5279, D7028	Determines elastic modulus (or storage modulus, G'), viscous modulus (or loss modulus, G'') and damping coefficient (Tan D) as a function of temperature, frequency or time.
Accelerated Long-Term Stress Relaxation or Creep	ASTM D2990	Time-temperature superposition (TTS) analysis to determine long-term properties during short-term tests.
Dynamic Mechanical Properties Melt Rheology	ASTM D4440	Measures the melt viscosity of polymer at a range of temperatures and shear rates.
Glass Transition (Tg) Analysis	ASTM D7028	Determine the Tg of a material.
Coefficient of Thermal Expansion (CTE)	ASTM E831	CTE can be measured over a temperature range and used for stress at temperature calculations or FEA modeling inputs.

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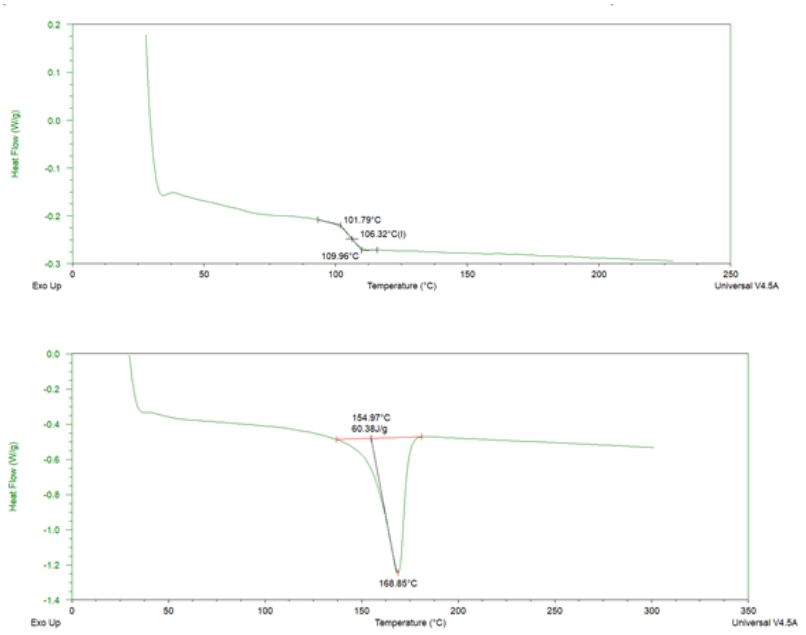
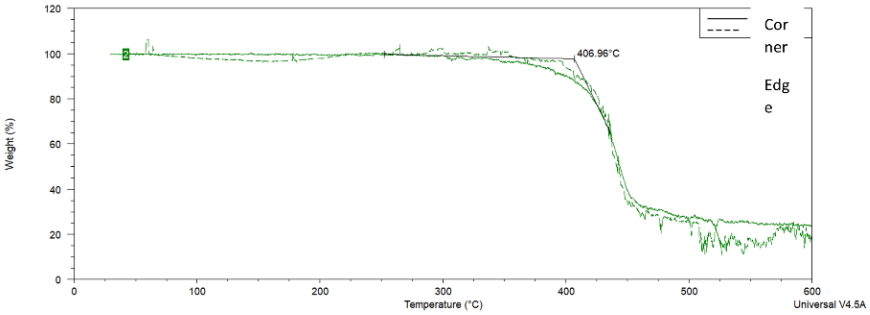
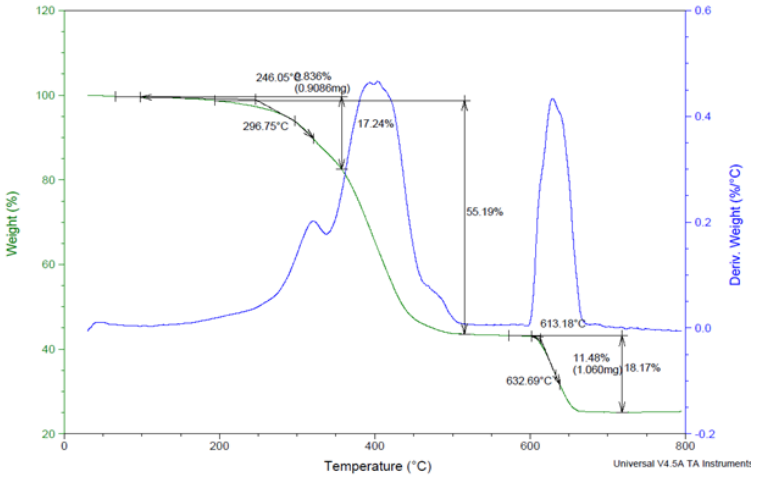
Differential Scanning Calorimetry (DSC)



Name	Reference	Description
Glass Transition (Tg) Analysis	ASTM D7426	Determines the Tg of a material.
Polymer Crystallinity	ASTM D3418	Area under the melt peak can be used to determine the percentage of crystallinity in a sample.
Degradation Temperature	ASTM D3418	The onset temperature of degradation can be identified and used for setting a processing window.
Heat of Reaction or Extent of Reaction	ASTM E2160	For curing chemistries, the heat of reaction (endothermic or exothermic) can be measured under different times and temperatures.
Heat Capacity	N/A	Heat capacity can be measured using an oscillating (or modulated) method.

Thermogravimetric Analysis (TGA)

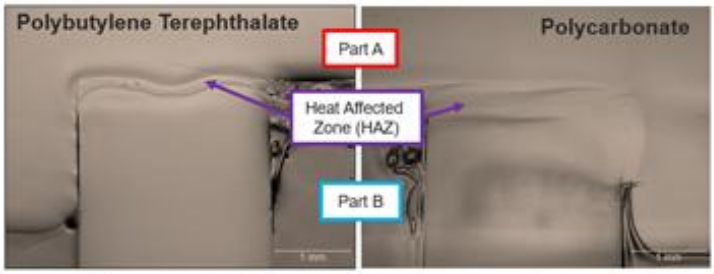




Name	Reference	Description
Moisture Analysis	ASTM E1131	Moisture has effects on polymer mechanical properties and joining operations, its wt.% can be measured
Filler Weight and Identification	ASTM E1131	Filler wt.% can influence polymer mechanical properties, it can be measured.
Degradation Temperature	ASTM E1131	The onset temperature of degradation can be identified and used for setting a processing window.

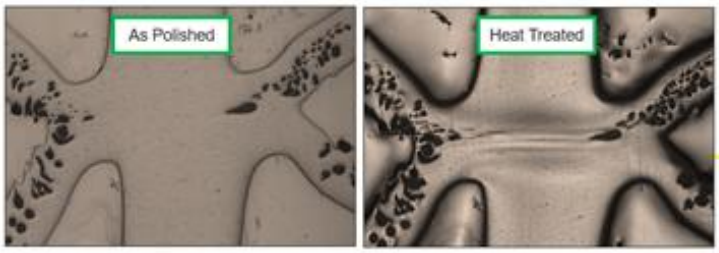
Microscopy

Semi-crystalline polymers show the heat affected zone (HAZ) lines due to a change in crystallinity in the heated area.



Good welds with intermolecular diffusion (no separation line across joint)

Amorphous polymers show the HAZ lines due to a change in polymer chain orientation in the heated area.



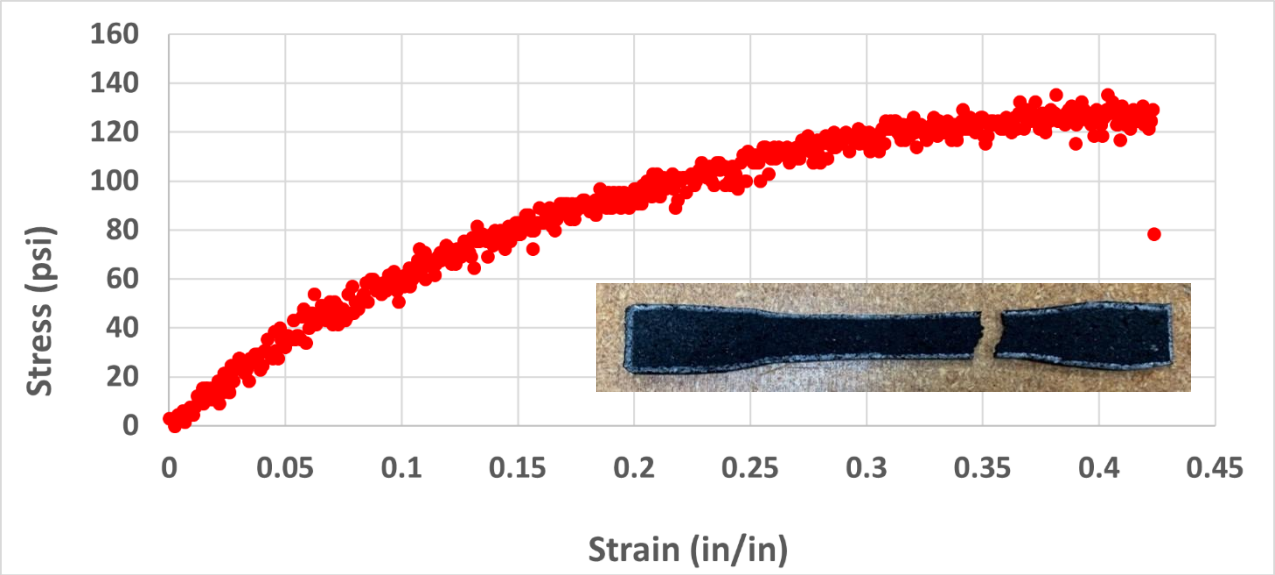
No intermolecular diffusion (separation line across joint)

Name	Reference	Description
Weld Evaluation, including intermolecular diffusion assessment	EWI Proprietary	Heating After Cross-Sectioning (HACS) Analysis is performed to show details of the weld quality such as intermolecular diffusion, gaps, voids, inclusions, cracks, flash, and degradation.
Surface Roughness	N/A	Keyence non-contact profilometer is used to measure surface roughness.
Fractography	N/A	Scanning electron microscopy (SEM) can be used to determine type and initiation point of failures
Filler Material Identification	ASTM E1508	Energy dispersive x-ray spectroscopy (EDS) can be used to atomically identify an unknown material

Leak Testing

Name	Reference	Description
Leak Testing – Pressure / Air	Custom per application	Assembly is pressurized with air and the loss in pressure over time is measured to quantify leak rate.
Leak Testing – Vacuum / Helium	Custom per application	Vacuum is pulled through the assembly and a Helium sniffer is used to check for discrete small leaks.

Mechanical Testing



Name	Reference	Description
Tensile	ASTM D638, ASTM D412	Rigid or elastomeric dogbone shaped samples are pulled to failure on an Instron.
Fatigue	ASTM D7791	Measure the decrease in elastic force at a specified tensile strain to determine polymer's ability to withstand cyclic load.
Hardness	ASTM D2240	Measure Shore A or Shore D hardness.

Polymer Aging

Name	Reference	Description
Ultraviolet Irradiation Aging	ASTM G154	Simulated direct sunlight weathering to determine a polymer's UV resistance.
Yellowness Index, Color Identification and Matching	ASTM E313, ASTM E1347, ASTM D2244	Colorimeter is used to measure color of an object on the XYZ or CIE Lab scales. Useful for determining color change of polymer after aging.
Accelerated Aging	N/A	Custom setups for inducing particular types of polymer degradation, such as hydrolysis or oxidation.