SABANCI UNIVERSITY INTEGRATED MANUFACTURING TECHNOLOGIES RESEARCH AND APPLICATION CENTER

Sabancı Üniversitesi

SU IMC SABANCI UNIVERSITY INTEGRATED MANUFACTURING TECHNOLOGIES RESEARCH AND APPLICATION CENTER

“CREATING AND DEVELOPING TOGETHER”

SU IMC is an industrial-scale research, technology development, and application center offering design, analysis, prototyping, manufacturing and process development services in relation to **composite materials, additive manufacturing** and **robotic manufacturing.**

INDUSTRIAL SCALE R&D

Built on 15,000 m² closed area with a 3,350 m² laboratory infrastructure, SU IMC is one of the very few research and application centers with a world-class manufacturing and testing facilities.

VISION

Create high value-added integrated manufacturing and composite technologies.

MISSION

To develop and apply high technology with our collaborators with our open innovation principle and manufacture high value-added products.

To gain competent human power in the field of integrated manufacturing and composite material technologies in the ecosystem of university-industry collaboration.

WHAT WE DO

PROTOTYPING AND PRODUCT DEVELOPMENT

- Design, analysis and optimization services, prototype manufacturing, process and product development of composite and 3D products,
- Solutions with a high qualified research and engineering team,
- Consultancy and open innovation platform for the industrial partners to provide fast, reliable and value added solutions.

RESEARCH AND APPLICATION

- Industrial-scale research and technology development center with well-known faculty members and researchers,
- Additive manufacturing and digital manufacturing technologies in the scope of multifunctional advanced composite materials and structures.

MANUFACTURING AND TEST SERVICES

- Advanced composite and additive manufacturing, mechanical and material characterization, flammability and wet chemistry test services.

PROFESSIONAL TRAINING

- Practical training of engineers and technicians by providing all aspects of Advanced Composites and Additive Manufacturing,
- Theoretical knowledge gained by participants will be practically supported by hands-on experiments.

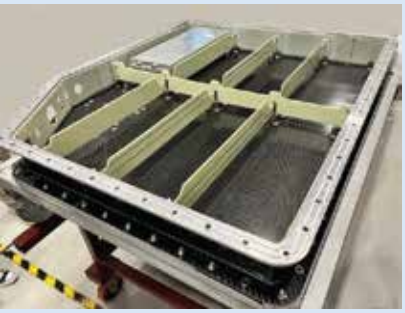
COMPOSITE TECHNOLOGIES CENTER OF EXCELLENCE (CTCE)

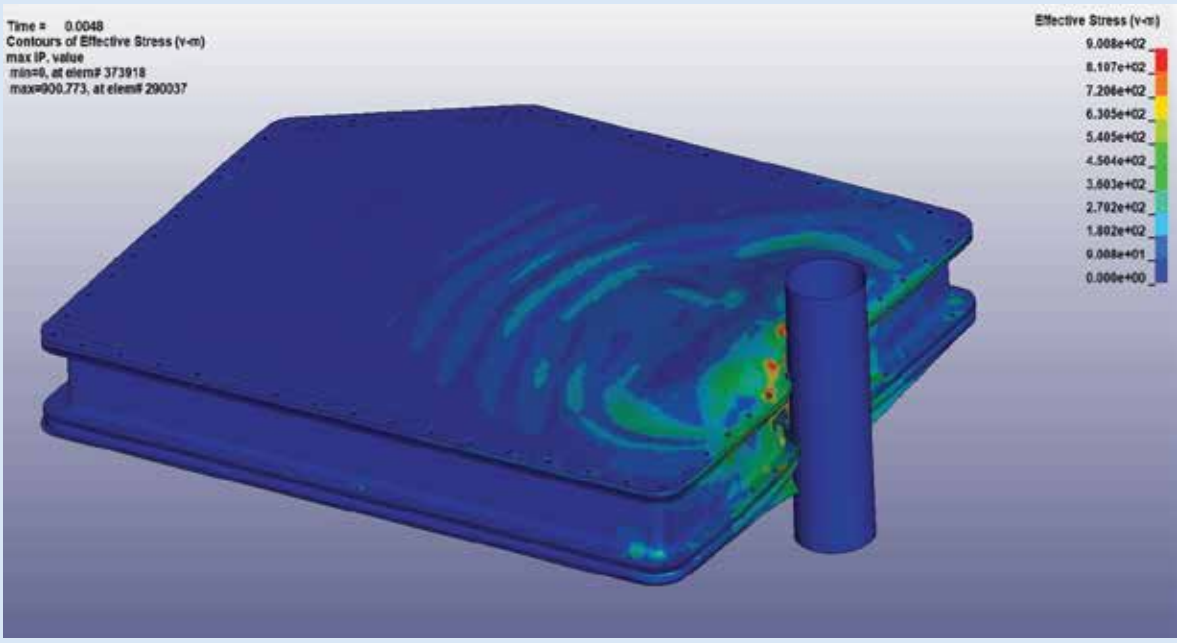
- Established as one of the most important research and technology development centers globally in composite materials.
- Combines industry and academia under the same roof. Researchers, designers, engineers, PhD students, postdoctoral fellows, faculty members and entrepreneurs co-exist in this ecosystem and get benefit from the interaction.
- Serves stakeholders by creating solutions depending on the customer's requirements.
- Covers all stages of the product development cycle including R&D, prototyping, commercialization and mass production.

CAPABILITIES

DESIGN AND ANALYSIS

Based on the customer needs, starting from the materials, method of manufacture, geometry, performance and the associated production cost, we provide high-quality design solutions.





We design and develop complete composite structural parts in the sense of styling of composite parts, mechanical analysis and manufacturing process.

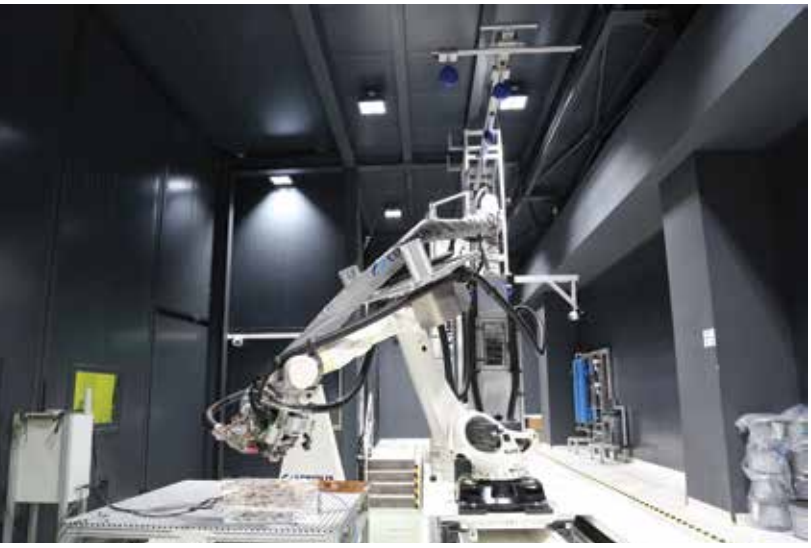
We develop novel design methodologies in order to simulate various problems based on the demands of automotive, aerospace and defence industries.

We provide simulation services to a wide variety of industrial problems including:

- Computer-Aided-Design (CAD) solutions,
- Detailed Structural Analysis (static and fatigue),
- Performance and failure analyses under various load conditions,
- Behaviour analyses including fatigue, creep and environmental effects,
- Dynamic crash simulations.

ADVANCED COMPOSITES AND ROBOTIC MANUFACTURING

High quality engineered composite parts can be produced for aerospace, defense, automotive and different industries utilizing both conventional and robotic based manufacturing technologies.



Automated Fiber Placement (AFP) Machine is capable of thermoset and thermoplastic composite part manufacturing

Autoclave; Diameter 1.5Mt , Length 3.0 Mt Pressure 20 bar, Temperature up to 400°C

- We conduct design phases and simulation and manufacturing, including research and development of advanced composite and robotic manufacturing processes encompassing both science and engineering aspects.
- We develop the use of reconfigurable manufacturing systems for SMEs and OEMs together with their cost and performance benefits. The facility is used for production of composite and metallic materials as well as testing services.
- We utilize Industrial Large Format Robotic Additive Manufacturing of polymer matrix composite parts, Robotic Machining and Robotic Abrasive Waterjet Cutting of composites and metals.
- The robotic machining and additive manufacturing cell can process both metals, thermoplastic and thermoset composites.

The facility features state-of-the-art equipment, including an industrial scale autoclave, a hot press, a CNC machining robot, an abrasive waterjet machining robot for composites and metals, and a wire EDM system for precision metal processing.

Digital Ply Cutter
Working Dimensions: 1800 mm x 3200 mm

Industrial Oven:
Working Dimensions: 1200 x 1200 x 1200mm
Temperature: 400°C
Vacuum Pump: 40 m3/h, 720 mmHg

Hot Press:
Dimensions : 500mm x x500mm
Pressure Force: 50 tons
Temperatura: 400°C

Large Format Additive Manufacturing (LFAM)

Robotic Milling Unit

Integration of industrial robotics with conventional and unconventional manufacturing processes leads the way to establish reconfigurable, cost-effective manufacturing systems enabling hybrid-manufacturing concepts.

Wire EDM:
Dimensions: 1300 x 1040 x 500 mm3
Wire travel in X-axis: 800 mm, Y-axis: 600 mm, Z-axis: 600 mm
Maximum cutting speed: 450 mm2/min

Abrasive Waterjet:
Capable of performing 3D cutting
Pressure up to 3750 bar

Cutting composite materials requires specialized tools and techniques due to their unique composition. Common methods for cutting composites include abrasive water jet cutting, CNC cutting, and diamond saw cutting. These methods ensure precision while minimizing damage to the material's integrity.

ADDITIVE MANUFACTURING

Multifunctional complex metal and polymer parts can be manufactured fast and reliably with novel Additive Manufacturing Technologies.

- We develop new hybrid processes for manufacturing of complex parts.
- We improve and enhance existing processes.
- We focus on super-alloys and ferrous alloys, high performance engineering polymers, composite and hybrid additive manufacturing processes.

Cold Spray, Electron Beam Melting Metal AM System (EBM), EOS M290 Selective Laser Melting Machine and DMG Mori Seiki Lasertec 65 3D Hybrid Process (Milling and Laser Deposition Welding) Machine are utilized for Metal Additive processes. In addition, vacuum H/T furnace, Dlyte surface improvement, ball mill system, sand-blasting, heat treatment and band-saw eqiupments are available for pre and post processes.

Direct Energy Deposition (DED) Additive Manufacturing Machine:

Building Volume: 650 x 650 x 560 mm
Laser Power: 3000W

Selective Laser Melting (SLM) Additive Manufacturing Machine:

Contruction Volume: 250 x 250 x 325 mm
Laser Power: 400 W

COLD SPRAY SYSTEM

Cold spray is a solid-state deposition technology which is utilized for coating, repair, 3-dimensional building and joining dissimilar materials with high density and homogeneity. The system accelerates metallic powder, which is injected into a carrier gas stream, beyond supersonic speeds. The metal particles stick on to the substrate surface and each other, aided by the high kinetic energy. With the help of this technology, thermal effects are minimized. This characteristic distinguishes Cold Spray Technology from other manufacturing and coating processes.

1 cermet nozzle
1 ceramic nozzle
1 plastic nozzle
Powder feeder (3+3 Lt)
N2, N2+He supply available (inactive)
Max. temperature: 1100 °C
Max. pressure: 70 bar (He: 30 bar)
Spray booth: 7.3 x 5 x 3.5 m3, sound insulation, steel frame
Cold Spray gun Integrated to Robotic system (Kuka Robot + positioner = KUKA KR70 R2100 + DKP-400 V2)
Maximum workspace size (robotic safe working area): 1m x 1m x 1m C

ELECTRON BEAM MELTING

Electron Beam Melting (EBM) is an advanced 3D printing technique that uses a high-energy electron beam to fuse metal powder. Each layer is heated to an ideal temperature tailored to the specific material, ensuring minimal residual stress and a refined microstructure. EBM allows for the production of high-density metal components with excellent mechanical properties and this technology enables the use of high-temperature melting alloys.

VACUUM H/T FURNACE

Heat treatment is a crucial post-processing step for parts manufactured using metal additive manufacturing technologies.
It enhances the mechanical properties, ensures the necessary hardness, microstructural homogeneity and reduces residual stress that may develop during the additive manufacturing process.

DLYTE SURFACE FINISHING

- DLyte is a patented technology for grinding, polishing, deburring, and rounding metal surfaces through ion transport with free solid bodies.
- It utilizes solid electrolyte particles that conduct electricity and eliminate oxides.
- Capable of processing complex geometries without causing micro-scratches or altering the original shape.

Electron Beam Melting Metal Additive Manufacturing System (Freemelt One

Powder bed temperature min. 1000 °C
Beam Power: Variable 0-6 kW
Build chamber: Ø100 x 210 mm H

Tube Furnace (Nabertherm)

Operating T max 1400 °C under vacuum
Temperature sensitivity ±5 °C

DLyte Surface Finishing

Based on a set of solid electrolyte particles to conduct electricity and to remove the oxides

POLYMER PROCESSING

Polymer Processing Facility offers the development of thermoplastic polymer compound formulations, masterbatch preparation and improved manufacturing processes.

Equipped with a twin-screw extruder with the capacity of up to 25 kg/h, a high shear compounding machine, an injection moulding, a film blowing system and two chemical reactors. Serving the customers in engineering plastics industry for novel compound production.

Provides the improvement of structural, thermal and mechanical properties of thermoplastic polymers and producing advanced functional composites based on industrial needs .

Twin Screw Extruder,
Temperature Up to 350°C
Throughput 25kg/h

Blow Film Extruder

High Shear Compounding Mixer

INTEGRATED MANUFACTURING TECHNOLOGIES RESEARCH AND APPLICATION CENTER

TESTING CAPABILITIES

MATERIAL CHARACTERIZATION LABORATORY

Material Characterization Laboratory covers the thermal, thermo-mechanical, rheological and structural characterization of all composite materials and individual components used in composite manufacturing. The lab can characterize the thermal properties of materials by means of thermo-gravimetric (TGA), various differential scanning calorimetry (DSC, Flash DSC, HPDSC) and thermal conductivity measurements.

- Thermal stability and degradation behavior of materials (DSC, TGA)
- Thermal transition of materials under controlled, variable heating and cooling rates
- Thermo-mechanical behavior of materials under load (DMA)
- Rheological behavior of materials under variable shear or temperature
- Thermal conductivity of materials
- Molecular weight analysis of polymers and oligomers
- Heat deflection temperature (HDT)
- Contact angle of liquids on surfaces
- Surface analysis via Stereo Zoom Microscopes
- X-Ray Diffraction Analysis Eqiupment
- Hardness Test Equipment
- Tribometer
- Scanning Electron Microscope (SEM) with Focused Ion Beam

Magnification range: 12x – 2.000.000x
Working distance range: 1 to 50 mm
FIB (Focused Ion Beam), EDS (Energy Dispersive X-ray Spectroscopy) and EBSD (Electron Backscatter Diffraction) analysis
Holder capacity: 9 for appropriately sized specimens
Lenses: in-lens SE, in-lens BSE, SE2

SEM (Scanning Electron Microscope)

Cu X-ray tube
5-axes Eulerian cradle sample stage with programmable X, Y, Z, Chi Phi movements
Detector pixel size max 75 µm
0D, 1D, 2D measurement capability
sample holders also for irregular samples and powder analysis
Program input capability of min. 0.001 mm increments
Configuration: Vertical Theta/2Theta and Theta/Theta geometry
Scanning angular range: - 110° < 2 theta < + 168° (depends on accessories)
Angular accuracy: Better than ± 0.01° over the whole 2-Theta range
Smallest selectable step size: 0.00001°
Focus: 0.4 x 12 mm LFF (Long Fine Focus)
Detectors: Scintillation counter, CeleriX 1D/2D multi strip detectors Silicon Drift Detectors (SDDs)

X-Ray Diffraction (XRD)

Hardness Tester

Load capacity range: 0.25 g – 62.5 kg
Vickers: DIN EN ISO 6507, ASTM E384, ASTM E92
Knoop: DIN EN ISO 4545, ASTM E384, ASTM E92
Brinell: DIN EN ISO 6506, ASTM E10
5 MP integrated high resolution camera
2.5X - 100X lenses
Traverse path of X/Y axes 120 mm x 120 mm

Rotary (pin-on-disc) module: Rotary disc maximum dia 60 mm, slide diameter range 0-30 mm
Linear (reciprocating) module: 25 x 50 mm2 table
Lubrication module
High temperature test module (test temperatures
from RT to 400 °C, step size 4°C), maximum
sample diameter 10-20 mm
Measurement sensitivity: 2 µm

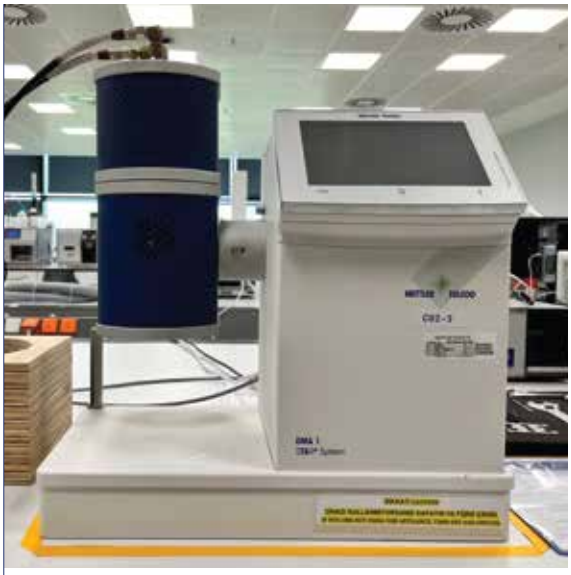
TRIBOMETER

Measures the mechanical properties of materials as a function of time, temperature, and frequency.

METTLER TOLEDO DMA/STDA 861E

ASTM D7028
ASTM D4065
ASTM D4473
ASTM D5024
ASTM D5056
ASTM D5023

- *Temperature range: -150 °C to 500 °C*
- *Working temeperature range: -100 °C to 450 °C*
- *Force range: 0.001 N to 40 N*
- *Measurement modes: Bending, tension,*
- *compression (max 300 Hz), shear (max 1000 Hz)*



Measures the mechanical properties of materials as a function of time, temperature, and frequency.

METTLER TOLEDO DMA 1

ASTM D7028
ASTM D4065
ASTM D4473
ASTM D5024
ASTM D5056
ASTM D5023

- *Temperature range: -150 °C to 600 °C*
- *Working temeperature range: -100 °C to 450 °C*
- *Force range: 0.001 N to 10 N*
- *Frequency range: max 300 Hz*
- *Measurement modes: Bending, tension, compression, shear*

ASTM E793
ASTM E794
ASTM D3895
ASTM E1269
TS EN ISO
11357
(1-2-3-4-5-6-7)

- Temperature range: -150 °C to 700 °C
- Working temeperature range: -100 °C to 450 °C
- Heating rate (RT to 700 °C): 0.02 K/min to 300 K/min
- Cooling rate: 0.02 K/min to 50 K/min
- Sensor type: FRS 6+ (HSS 9+)
- Special modes: ADSC, IsoStep™, TOPEM®
- Sample robot: 34 sample positions

Glass transition temperature and step height, temperature and enthalpy of melting and crystallization, specific heat capacity, characteristic reaction-cure temperatures and times, enthalpy of reaction and degree of conversion, oxidation induction time and temperature, crystallization kinetics.

METTLER TOLEDO DSC 3+

Custom
Demand

- Temperature range: -85 °C to 400 °C
- Cooling rate: 6 K/min to 2400000 K/min
- Heating rate: 6 K/min to 3000000 K/min
- Sensor type: UFS 1 (standard)
- Number of thermocouples: 16
- Signal time constant : 1 ms (USF 1)
- Option: Microscopy

Study thermally induced physical transitions and chemical processes, processes involving the formation of structure in materials, direct measurement of rapid crystallization processes, investigation of the mechanism of action of additives under near-production conditions, comprehensive thermal analysis of materials in a very short time, analysis of very small sample amounts, determination of data for simulation calculations.

METTLER TOLEDO Flash DSC

ASTM D5885
ASTM D5483
ASTM D6186

- Pressure range: 0 MPa to 10 MPa
- Temperature range: RT to 700 °C
- Working temeperature range: RT to 450 °C
- Sensor type: FRS 6+ (HSS9 +)

Study DSC measurements under increased pressure for material testing, process development or quality control, curing of resins (e.g. polycondensation reactions), curing reactions of polymers and oxidation stability

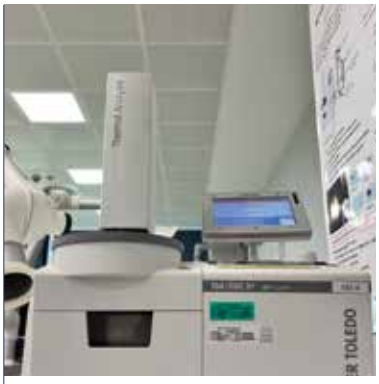
METTLER TOLEDO HP DSC 2+ (HP DSC)

ASTM E831
ASTM E1545
ASTM E228
TS EN 2155-12
TS ISO 11359-2

- Temperature range: -150 °C to 600 °C
- Working temeperature range: -100 °C to 450 °C
- Force range: 0.001 N to 10 N
- Frequency range: max 300 Hz
- Measurement modes: Bending, tension, compression, shear

Measurement of expansion coefficients.

METTLER TOLEDO TMA STDA1+



ASTM D5805
TS EN ISO
11358-1

- Simultaneous DSC heat flow measurement
- Temperature range: RT to 1600 °C
- Working temeperature range: RT to 1100 °C
- Heating rate: 0.02 K/min to 150 K/min
- Dynamic weighing range: 1 g
- Weighing accuracy,precision: 0.005 %, 0.0025 %
- Sample robot: 34 sample positions

• TGA: Quantitative content analysis, sublimation, evaporation and vaporization, thermal stability, oxidation reactions and oxidation stability, identification of decomposition products, identification of decomposition products, reaction and transition enthalpies
• DSC: Glass transitions, melting behavior, crystallization, heat capacity

METTLER TOLEDO
TGA/DSC 3+

ASTM E1252
EN 6042

- Smart iTR with Diamond and GE plate
- Specac Complete KBr Pellet Prep Kit
- 15 ton manuel hydraulic press
- Pellet holder, pellet die
- Aldrich FTIR research library
- Software: OMNIC

Fourier Transform Infrared Spectroscopy (FTIR) , analysis is an analytical technique used to identify organic, polymeric, and in some cases, inorganic

THERMOFISHER SCIENTIFIC
NICOLET™ IS50

ASTM D5279
ASTM D4440
EN ISO 6721-10

- Temperature range (peltier): 0 °C to 200 °C
- Temperature range (furnace): RT to 450 °C
- Maximum torque: 200 mNm
- Maximum angular frequency: 628 rad/s
- Maximum speed: 3000 rpm
- Normal force range: -50 N to 50 N
- Test atmospehre: Air, Nitrogen

Composite, resin, rubber, thermoplastic, thermoset, elastomer. Amplitude sweep, frequency sweep, temperature sweep, viscosity, (storage, loss, damping), gel time and isothermal measurements. Solid rectangular fixture (SRF) in torsion is a thermal analysis technique for determining glass transition, frequency sweep, isothermal measurements.

ANTON PAAR
MRC 702 TWIN DRIVE

ASTM D5279
ASTM D4440
EN ISO 6721-10

- Temperature range (peltier): 0 °C to 200 °C
- Temperature range (furnace): RT to 450 °C
- Maximum torque: 200 mNm
- Maximum angular frequency: 628 rad/s
- Maximum speed: 3000 rpm
- Normal force range: -50 N to 50 N
- Test atmospehre: Air, Nitrogen

Composite, resin, rubber, thermoplastic, thermoset, elastomer. Amplitude sweep, frequency sweep, temperature sweep, viscosity, (storage, loss, damping), gel time and isothermal measurements.

ANTON PAAR
MRC 302 TWIN DRIVE

ASTM 3530
EN 2330
EN 2558

- *Temperature: max 300 °C*

Determination of volatiles content of composite material prepreg, moisture absorption, conditioning, drying

POL-EKO APARATURA SLW 115 STD
DRYING OVEN

ASTM D2584
TS 1177
EN ISO 1172
EN 2564
ASTM D3171-B

- *Maximum temperature: 1200 °C*
- *Maximum working temperature: 1150 °C*
- *Inner dimensions (H x W x D): 28 x 28 x 35*

Constituent content of glass fiber reinforced composites, ignition loss of cured reinforced resins, void content of reinforced plastics, constituent content of composite prepreg (fiber content, fiber areal weight and matrix content by matrix burn-off)

PROTHERM PLF 120/27
ASH FURNACE

TS EN ISO 3219
ASTM D4287
ISO +A19
B192884
BS 3900

- *Cone Spindle: 1,3,6*
- *Viscosity range: 0.2 Poise to 15.000 Poise*
- *Temperature range: 50 °C to 235 °C*
- *Shear rate: 10 s-1 to 13.000 s-1*
- *Speed rate: 5 rpm to 1000 rpm*
- *Sample size less than 1 mL*
- *Software: Capcalc32*

Viscosity measurements for composite polymers, resins, paint, gels, gums, food products.

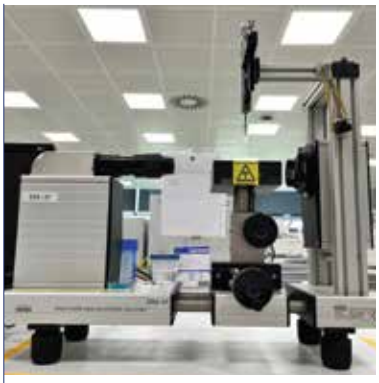
BROOKFIELD CAP 2000+
VISCOMETER

TS EN ISO 1183-1
TS EN ISO 1183-3
ISO 10119

- *Gas type: Helium (He)*
- *Sample cell types and nominal volumes:*
- *Micro cell (4.25 cm3), Meso cell (1.75 cm3), Nano cell 0.25 cm3*

Determination of true volume and true density,

QUANTACHROME
MICRO-ULTRAPYC 1200E



KRÜSS DSA 10-MK2
DROP SHAPE ANALYSIS SYSTEM

INTERNAL /CUSTOM DEMAND

- *Methods: Tangent method, H/W method, Circle fitting.*
- *Manual syringe, camera, light source.*
- *Temperature: room temperature. Liquid: water*

Contact angle, θ (theta), is a quantitative measure of wetting of a solid by a liquid.

POL-EKO APARATURA
KKS 240 IG SMART PRO

EN 2743
ISO 291
ISO 618

- *Temperature range: 0 °C to 100 °C*
- *Temperature resolution: 0.1 °C*
- *Relative humidity range: 10 % to 90 %*
- *Relative humidity resolution: 1.0 %*

Conditioning, drying, moisture absorption

SHIMADZU LC-2040-C PLUS
(HPLC)

EN 6040

- *Detector: Shimadzu SPD-M20A Diode Array Detector*
- *Maximum pressure: 66 MPa, 44 MPa, 22 MPa*
- *Configuration: Four-solvent low-pressure gradient*
- *Temperature control: max 90 °C*
- *Wavelength range: 190 nm to 800 nm*
- *Light source: Deuterium (D2) lamp (Standard), tungsten (W) lamp*
- *Injecton volume range: 0.1 µl to 100 µl*

Epoxy resins, prepregs

INSTRON CEAST HDT VICAT HV3
HDT

HDT:
ASTM D648
TS EN ISO 75-1, 2, 3

VICAT:
*ISO 306**
*ASTM D1525**

- *Temperature range: 25 °C to 300 °C*
- *Vicat Method A: 10 N*
- *Vicat Method B: 50 N*
- *HDT Method A: 1.8 N/mm²*
- *HDT Method C: 8.0 N/mm²*
- *Testing stations: 3*

Thermo-mechanical systems are used to characterize the behavior of plastic materials at high temperatures, measuring the heat deflection temperature (HDT) and the Vicat softening temperature (Vicat).

ISO 22007-1, -2

- Thermal conductivity: 0.005 to 1800 W/m/K
- Thermal diffusivity: 0.01 to 1200 mm^2/s
- Thermal effusivity: 20 to 55000 $Ws/m^2/K$
- Specific heat capacity: Up to 5 $MJ/m^3/K$
- Reproducibility: Typically better than 1 %
- Temperature range: -60 °C to 180 °C
- Sensor: 300 °C, -60 °C - 180 °C, Cp gold cell

Analysis of thermal transport properties - including thermal conductivity, thermal diffusivity and specific heat capacity

HOTDISK - TPS 2500S
THERMAL CONDUCTIVITY ANALYSIS

INTERNAL/
CUSTOM
DEMAND
EN 2329
EN 2331
EN 2557

- Positions: 6-positions
- Temperature range: RT to 300 °C
- Measuring range: 0.1 % - 100 %
- Automation: Immersion, Removing,
- Washing, Recovery, Cooling
- Solvent recovery: > 90 %
- Water consumption: From 1.0 l/min

Determining resin, fiber and/or fiber areal weight of prepregs (FAW), fiber desizing

SOLVENT AUTO EXTRACTOR

INTERNAL
/CUSTOM
DEMAND

- Solvent: DMF,Detector: RI, Light
- Scattering, Viscometer
- Detector module temperature: 55 °C
- Method: Light Scattering detector, Conventional Calibration method (PMMA based evaluation), Triple Detection determined MW, intrinsic viscosity, hydrodynamic radius measurement
- Column calibration range: 600 Da to 2730000 Da

Measurement of absolute molecular weight, molecular size, intrinsic viscosity, branching and other parameters.

MALVERN VISCOTEK GPCMAX
GEL PERMATION CROMATOGRAPHY

INTERNAL
/CUSTOM
DEMAND

- Balance measuring range: 1 mN/m to 2000 mN/m
- Density: max 2.2 g/cm3
- Density resolution: 0.0001 g/cm3
- Maximum load: 210 g
- Force resolution: 0.1 µN
- Temperature control range: -20 °C to
- +200 ° C

Surface tension (Wilhelmy plate methods), Critical Micelle Concentration (Wilhelmy plate methods) Density (density probe)

KSV INSTRUMENTS SIGMA 700
TENSIOMETER

Metal Microscope / Nikon LV100ND	• *Zoom Ratio: 8:1* • *Zooming Range: 1-8x* • *Total magnification (with standard set) : 5-480x (10-80x)* • *Working Distance: 78mm*	*A manual microscope with top/bottom illumination that meets a variety of observation, inspection, research and analysis needs in a wide range of industrial fields. Application areas: metallurgy, composites, metal fabrication, fabrics/textiles, crack and failure analysis, telescope optics*

OPTICAL & STEREO MICROSCOPE

Stereo Microscope / Nikon SMZ800N	• *LV-S32 3x2 stage (Stroke: 75 x 50 mm with glass plate) ESD compatible* • *LV-S64 6x4 stage (Stroke: 150 x 100 mm with glass plate) ESD compatible* • *LV-S6 6x6 stage (Stroke: 150 x 150 mm) ESD compatible*	*Compatible with brightfield, darkfield, simple polarization, DIC, epifluorescence and two-beam interferometry observations. Also phase contrast and diascopic illumination DIC observations are possible. Supports different and advanced research, analysis and inspection.*

OPTICAL & STEREO MICROSCOPE

ASTM D3171 (F)	• *The microwave cavity has a volume of over 70 liters* • *Two 950 Watt magnetrons for a total of 1900 Watt* • *Infrared sensors combined with an in-situ temperature sensor* • *Digestion rotors: SK-15, MAXI-44,* • *MAXI-24 HP*	*Acid digestion, determining constituent content of carbon composites*

MILESTONE CONNECT ETHOS UP HIGH PERFORMANCE MICROWAVE DIGESTION SYSTEM

ASTM D3171 (B) EN 2564	• *Maximum temperature: 450 °C* • *Power: 720 W* • *Bottle dimensions: 500 ml x 3*	*Acid digestion, constituent content of composite materials (carbon fiber reinforced composites)*

WITEG WHM-12391 HEATING MANTLE

MECHANICAL TESTING AND STRUCTURAL HEALTH MONITORING LABORATORY

Mechanical properties of all kinds of materials are characterized and reported in accordance with international standards, accredited testing services. We provide testing services by using our state-of-the-art testing capabilities coupled with experienced professionals in the field.

Metallic and non-Metallic Materials Properties Development and Standardization (MMPDS) data, Design Allowables (DA), Fatigue and Damage Tolerance (F&DT) characteristics are provided.

Quasi Static and Dynamic (Fatigue, Torsional) Tests are held at 100KN and 250KN load cell capacity Universal Testing Machines coupled with temperature chambers (-100°C +400°C). Materials under stress are observed via DIC camera system for strain mapping and extensometer, video-extensometer and strain gauges for strain measurements.

UNIVERSAL TEST MACHINES
MECHANICAL PROPERTIES

INSTRON 1

10N, 5kN and 100kN Load Cell Capacitiy
Quasi Static Tests
Heating Chamber Tests at -100 ° C and +350 ° C
Strain Gauge, Contact Extensometer

INSTRON 2

100kN Load Cell Capacitiy
Quasi Static Tests
Heating Chamber Tests at -90 ° C and +350 ° C
Strain Gauge, Contact Extensomet

INSTRON 3

250kN Load Cell Capacitiy
Dynamic and Quasi Static Tests
Fatigue Tests
Heating Chamber Tests at -150 ° C and +350 ° C
Video Extensometer, Strain Gauge, Contact Extensometer

INSTRON 4

250kN Load Cell Capacitiy
Dynamic and Quasi Static Tests
Fatigue Tests
Torsional Tests
Heating Chamber Tests at -150 ° C and +500 ° C
Strain Gauge, Contact Extensometer

CLIMATIC CABINETS AGING AND CONDITIONING

VÖTSCH VC3 71500

VÖTSCH CLIME EVENT C/1500/70/3

Tests for the aging and moisture retention capabilities of the materials
Temperatures between -70°C and +180°C, Humidity levels between 10% and 98%
Aging can be carried out under UV light exposure.

Zwick-Roell Vibrophore 100 High Cycle Fatigue Tester

Maximum load capacity: 100 kN, Test frequency range: 30-285 Hz

Test standards: ASTM E466
Grips for M10 and M12 threaded specimens
Test temperature max. 1100 °C
Tensile test without extensometer at high temperature
Only load-controlled tests

Raagen ETM 100 S1 Creep Tester

Maximum load capacity: -/+ 100 kN
speed range: 0.001 - 100 mm/min
Temperature range: 200 - 1100 °C
Conducting tests up to 10 000 hours
Grips for M10 and M12 threaded specimens
Tensile test with or without extensometer at high temperature
Test standard: ASTM E139
Both load and strain-controlled tests

IMPACT DEVICES
IMPACT ENERGY MEASUREMENTS

INSTRON CEAST 9050
PENDULUM IMPACT DEVICE

Impact tests on notched or non-notched materials.
Pendulum Impact Energy Maximum Capacity 50 J
charpy and izod

INSTRON 9400
DROP TOWER TEST MACHINE

Impact Drop Tower Impact Energy Up To 400 J

The purpose of using it is to cause damage on the surface of samples like compression after impact test.




NON-CONTACT MEASUREMENT TECHNOLOGIES STRUCTURAL HEALTH MONITORING

ACOUSTIC EMISSION ANALYSIS, NDT, DIC STRAIN MEASUREMENTS

Quantitative measurements of the shape, displacement, and strain of test objects

Acoustic Emission Analysis
Thermal NDT
High-resolution Digital Image Correlation (DIC), Thermography, Acoustic Emission and Fiber Bragg Grating (FBG) based sensors.
Ultrasonic Immersion Tank
X-Ray Computed Tomography (X-Ray CT)

Ultrasonic Immersion Tank TECHNITEST Triton

1500 x 1000 x 1000 mm3 tank size
A-scan, B-scan, C-scan capability
Pulse width range: 50 ns - 500 ns
Double Transmission, Through Transmission, Pulse-Echo Scan, Gimball Scan for slightly curved surfaces
Motorized Turntable for discs and small cylinders (maximum diameter 50 - 400 mm)
4 motorized axis system (X, Y, Z, U)
Phase Array Inspection
Metallic and nonmetallic specimen inspections

X-Ray Computed Tomography Baker Hughes Phoenix Vtomex M300

Detail detectability > 1 µm with a microfocus tube and > 0.6 µm with a nano-focus tube, offering industryleading magnification for highly absorbing samples
With a maximum voltage/power of 300 kV/500 W for the Microfocus and 180 kV/20 W for the high-power nano-focus tube
Max. sample size of up to Ø500 x 800 mm in height (scanning area max. Ø290 x 400 mm height)
Extremely fast CT data acquisition with up to 30 fps and >10000:1 dynamic range
High measurement accuracy (SD (µm) ≤ (3.8 + L (mm)/100))
Optional Dynamic detector 410 x 410 mm (16" x 16"), 100 µm pixel size, 4048 x 4048 pixels (16 MP) for doubled CT resolution

WET CHEMISTRY LABORATORY

Equipped with several utilities for experiments from the production of newly designed monomers and nanomaterials to polymer synthesis. The utilities in the lab bring innovative solutions in the field of textiles, hygiene, household goods, automotive, aerospace and energy.

- Nanomaterials are synthesized by applying wet chemistry techniques, catalytic growth and core-shell electrospinning technology.
- Surface functionalization is performed to get better interfacial interactions between nanomaterials and the chosen matrix.
- Multi-functionality is provided to different surfaces such as fabrics, metals and ceramics.
- Nanomaterials (graphene, CNTs and HNTs) can be synthesized and incorporated into resins or thermoplastics.

FLAMMABILITY TESTING LABORATORY

Offering flammability testing service according to aerospace and railway industry standards which require detailed and sensitive handling and execution. Moreover, textiles, foams, construction materials, engineering plastics andpolymers can be tested per related standards of each industry. Comply with ASTM, ISO, FAR, EN45545, UL-94, BOEING, AIRBUS standards.

Facility is equipped with,

- Cone calorimeter
- Smoke Density and Toxicity Chamber
- Limiting Oxygen Index
- Multipurpose Burner Tester

FLAMMABILITY LABORATORY EQUIPMENTS

LIMIT OXYGEN INDEX

Min. amount of oxygen to ignition

- *EN 45545-2*
- *BS 2782 PART 1*
- *NES 715*
- *ISO 4589-2*
- *ISO 4589-3*
- *ASTM D 2863*

MULTIPURPOSE BURNER TESTER

FAA vertical, horizontal, 45 and 60 degree Bunsen burner tests

- *UL 94*
- *FAR PART 25.853 APPENDIX F PART I*
- *AITM 2.0002A*
- *AITM 2.0002B*
- *AITM 2.0003*
- *BOEING BSS 7230 F1*
- *BOEING BSS 7230 F2*
- *BOEING BSS 7230 F4*

CONE CALORIMETER

- *ASTM E 1354*
- *ISO 5660 PART1&2*
- *ASTM E 1550*
- *ASTM E 1740*
- *ASTM D 5485*
- *ASTM D 6113*
- *CAN ULC 135*
- *BS 476 PART 15*
- *NFPA 271*
- *AS/NZS 3837*
- *EN 45545-2*

Heat release rate,
Time to ignition,
Mass loss rate,
Smoke release rate,
Effective heat of combustion,
Rate of release of combustion

SMOKE DENSITY AND TOXICITY

- *ISO 5659-2:2012*
- *NFPA 258*
- *FAR PART 25.853 APPENDIX F PART V*
- *AITM 2.0007*
- *AITM 3.0005*
- *BOEING BSS 7238*
- *BOEING BSS 7239*
- *EN 45545-2*

Specific optical density under flaming and non-flaming conditions,
The extraction of toxic gas measurement

DIRECT DIGITAL MANUFACTURING PLATFORM (DIMAP)

The aim of the Platform is to develop additive manufacturing processes supported by smart production systems, direct manufacturing of complex and functional products, provide training, consultancy and prototypes on "Digitalization and Additive Manufacturing" and provide transformation and support for Target Groups to reach EU standards.

Target groups are SMEs, Start-Ups, Companies, Institutions, Universities, R&D and Design Centers.

The list of equipments;

1. Electron Beam Melting Metal Additive Manufacturing System **(FREEMELT + DLYTE /Freemelt One + Dlyte Pro 500)**
2. Cold Spraying System **(TITOMIC /PCS-100 High Pressure Cold Spray System)**
3. Tube Furnace **(NABERTHERM/ RHTH - 120/600/18)**
4. CNC Lathe **(DMG MORI/ CLX 350 V3)**
5. Ball Mill System **(FRITSCH/ Pulverisette 5 Premium Line)**
6. X-Ray Diffraction Analysis Eqiupment **(GNR/ Explorer)**
7. Microstructure Specimen Preparation Equipment **(STRUERS/ Tenupol-5)**
8. Hardness Test Equipment **(QNESS/ 60A Evo)**
9. Creep Tester **(RAAGEN/ETM-100-S1)**
10. Tribometer **(UTS/ Tribolog)**
11. Three Dimensional **(3D) Scanner (HEXAGON/Smartscan He R12)**
12. Ultrasonic Immersion System **(TECNITEST/Triton 2000)**
13. Scanning Electron Microscope (SEM) with Focused Ion Beam **(ZEISS/ Crossbeam 350)**
14. X-Ray Computed Tomography (CT) **(GE-BAKER HUGHES/Vtomex-M300)**
15. Fatigue Tester **(ZWICKROELL/ Vibrophore 100)**
16. Wire EDM (**ONA/ AV60 A1)**

Platform Partners

* Instrument for Pre-Accession (IPA), EU supported project

Sabancı Üniversitesi

SU IMC SABANCI UNIVERSITY INTEGRATED MANUFACTURING TECHNOLOGIES RESEARCH AND APPLICATION CENTER

COMPOSITE TECHNOLOGIES CENTER OF EXCELLENCE

OUR QUALITY CERTIFICATES

AS9100D CERTIFIED ISO 9001

International Organization for Standardization ISO 17025

AS9100D
Quality Management Systems
Requirements for Aviation, Space, and Defense Organization

TS EN ISO/IEC 17025:2017
Testing and Calibration Laboratories
TS EN ISO 527-1
TS EN ISO 527-2

OUR CUSTOMER APPROVALS

TÜRKHAVACILIK UZAYSANAYİİ

TPS 702- COMPOSITE MACHINING
TPS 740- RESIN IMPREGNATED GLASS, CARBON AND ARAMID FIBER REINFORCED COMPOSITE PARTS MANUFACTURING
MECHANICAL TESTS

TURKISH TECHNIC

POPM 2.6.22-THERMOSET COMPOSITE PANEL PRODUCTION
PROCEDURE: THERMOSET COMPOSITE PANEL MACHINING

TEI

SQMS
SUPPLIER QUALITY MANAGEMENT SYSTEM

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