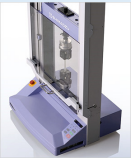



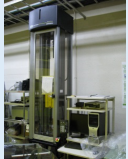












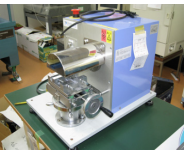


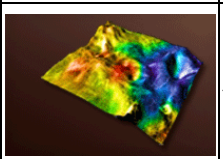
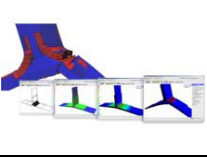


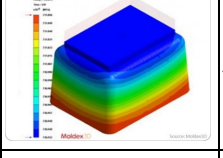
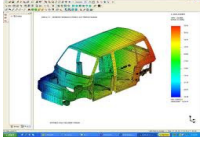
	Equipment	Photo	Company (Type)	Specifications	Since
1	Hydraulic double belt press		HELD (Germany)	Hydraulic pressure enables uniform pressing Max. temp.: 380 °C Max. pressure: 8 MPa Max. speed: 15 m/min.	2010
2	Stamping press		SANKI SEIKO Co. Ltd. CFR-1210-200FG	Output: 200-ton Board size: 1200 x 1000 mm Shut height: 200 mm Max. speed: 500 mm/sec. Die clamber: Air Die lifter: Air Data logging function for recording	2013
3	Box type IR heater		NGK INSULATORS, Ltd.	Far Infrared Ray Heating System Effective heating area: 1000 x 1000 mm Each of 8 points at the top or bottom can be controlled independently High density under Nitrogen-heating environment	2013
4	Heating and cooling press (steam)		MATSUI MFG Co, Ltd/ MIURA Co., Ltd./ Kaken Geneqs Inc.	Consist of Boiler, Cooling Water Circuation System and Temperature Controller Quick heat and cool down from ambient to 150 °C	2010
5	Vacuum press		MEIKI Co., Ltd. MHPC-VF-350-350	Output: 40-to Max. temp.: 300 °C Degree of vacuum: 26.7 hPa (20 Torr) Mold size: 245 x 245mm flat plate	2013
6	800-ton Stamping press		SUMITOMO HEAVY INDUSTRIES,LTD. HCF-800	Output: 7850kN Board size: 1500 x 2000 mm Shut height: 300 mm Stroke: 800mm Mx. Speed: 600 mm/sec.	2016
7	6 axes Transfer Robot		Kado-corporation/KUKA KR240 R3330	Payload: 210kg Max. reach: 3326mm Repeatability: 0.08mm Rail Length: 5m	2016
8	Heater		Kado-corporation /NGK INSULATORS, Ltd.	Heating area: 1500x700mm Heater number: 60 Heater capacity: 153.6kW	2016
9	Mold Temperature Controller		Kado-corporation /REIKEN TES-0-39kWHHL KCW III -25fza	High temp.Low temp.2Line Max.Temp.:300°C Heating Medium: Oil Flow rate(Low temp.): 200L/min Flow rate(High temp.): 350L/min	2015
10	Mold racks		Transcale	Store and manage large molds	2010
11	Overhead traveling crane		NIPPON HOIST Co., Ltd. NHEY2.8THA	Max. lifting capacity: 2.8-ton	2009
12	Digital cutter		Zund (Switzerland)	Cutting area: 1330 x 160 mm Max. processing speed: 80 m/ sec. Accuracy: ±0.02 mm Imput processing data such as DXF file, etc...	2013

13	Differential scanning calorimeter		NETZSCH (Germany) DC200F3 Maia	Temp. Range: -70~600 °C Available auto sampler	2013
14	Thermogravimetry-differential thermal analysis (TG-DTA)		Bruker AXS (Germany) TG-DTA2020SA	Temp. Range: ~1550 °C Available auto sampler	2013
15	Dynamic mechanical analysis (DMA)		TA Instruments RSA-G2	Dynamic force range: 0.001~35 N Temp. range: -150~600 °C Modulus range: $10^3 \sim 3 \times 10^{12}$ Distortion control method	2013
16	Microscope raman spectroscopy		HORIBA Ltd.	Equipped Laser: 457, 488, 514, 785 nm Spatial resolution: 1 μm Large spectroscopy: f=800 mm Confocal optical system Available thermostat chamber and/ or tensile tester	2013
17	3D X-ray microscopic CT scanner		YAMATO Scientific Co., Ltd.	Spatial resolution: 0.75 μm Max. scan range: 45 x 45 mm Available thermostat chamber and/ or tensile tester	2013
18	Digital microscope		HiROX KH-8700	Resolution: 1920 x 1080 pixel Display color: Approx. 16,770,000 colors Frame rate: 24 Frame at 1600 x 1200 pixel resolution Contrast Ratio: 1000:1 (typ) Display size: full HD LCD 21.5" Monitor	2013
19	Desktop tension system		TOKAI TESTING MACHINE MEF, Co., Ltd.	Load cell capacity: 2/200N switch Tension speed: 0.01 ~ 3.0 mm/min Tension experiment--single Carbon Fiber, resin film-- under various temperature Desktop type with high resolution on digital microscope stage	2013
20	Soft X-ray thickness gauge		FUTEC	Tungsten X-ray tube Accelerating Voltage: 15 kV Measurable Size: 240 mm	2015
21	Automatic 2D soft X-ray thickness gauge		FUTEC	Tungsten X-ray tube Accelerating Voltage: 15 kV Measurable Size: 210 x 300 mm Maximum scanning speed: 250 mm/sec	2017
22	Laser Thickness Gauge		FA Systems	High-Accury Laser Displacement Sensor LK-G5000 (KEYENCE) Measurable Length:150 mm	2015
23	High-speed video camera		Simadzu Corporation HPV-2	Recording speed: Max. 1 Mfps Frame rate: 100 frames Resolution: 312 (Horizontal) x 260 (Vertical)	2013
24	High-speed video camera		PHTRON Limited. FASTCAM SA-X	Resolution: 1024 x 1024 pixel, 12500 fps 12-bit ADC Built-in data logger synchronous system (1MHz, 16-bit, 2ch)	2013
25	Thermograph camera		Japan Laser Corporation	Resolution: 640 x 512 pixel Built-in band pass filter	2013

26	Thermograph		FLIR Systems, Inc. CPA-SC7500	Resolution: 320 x 256 pixel Max. digital frame speed: 20 kHz Thermal resolution: 0.02 °C	2013
27	Scanning Electron microscope		JEOL Ltd.	magnification: $\times 5 \sim \times 300,000$ Pressurized Voltage: 0.3kV~30kV Resolution: 3nm(30kV)(WD=8mm) 8nm(3kV) 15nm(1kV) Max. Sample Size: 200mm ϕ Sample Stage Mobilization Area · Slope: Eucentric Specimen Stage: X : 125mm Y : 100mm Z5~80mm, -10°~+90° Full Observation over 177mm ϕ (5-axis motor stage)	2016
28	Energy dispersive X-ray Analyzer		JEOL Ltd.	Dry SD Detector · built-in JSM-IT300LV Useful Detection Area: 10mm ² more Detectable Element: Be~U Chlorine, Oxygen, Sulfur Resolution: less than 129eV X-ray extraction angle: more than 35 degree Mapping/ Pixel: more than 4096x3072/ 1 PC integration	2016
29	High-Speed Microscope		KEYENCE Corporation VW-9000	Able to record up to 230,000 fps An LCD monitor, light source and HDD built into an all-in-one design Automatically determine changes in motion Graphing and quantifying images	2014
30	Digital microscope		KEYENCE Corporation VHX-1000	By synthesizing images taken at different distances, image that in focus overall can be displayed	2010
31	Laser scanning microscope		KEYENCE Corporation VK-X250/X260	Resolution of Height: 0.5nm(16bit) Resolution of Width : 1nm Laser Measurement Speed: 4Hz ~ 120Hz, 7900Hz Magnification: ~28800 Objective lens x20, Apo x150 on 23" monitor Photodetector : Photomultiplier 16bit sensing Field (min. field area) : 11 μ m~5400 μ m	2015
32	Wide-Area 3D Measuring System		KEYENCE Corporation VR-3200	Measurement XY area: 200mmx100mm Measurement Z area: 10mm 100 mm for connection Accuracy XY: $\pm 5\mu$ m Accuracy Z: $\pm 3\mu$ m Measurement Principle: XYZ : Triangulation method	2016
33	Micro droplet testing system		TOHEI SANGYO Co., Ltd. HM410	Make resin micro droplet on monofilament Measure interfacial shear strength between resin and monofilament Testing temp.: ambient to 400 °C Measuring head movement speed: 0.06 mm/ min.	2009
34	Acoustic emission system		Physical Acoustics Corporation (USA)	Acoustic Emission system 4-channel AE Win analysis software 18-bit A/ D converter 40 MHz high resolution Measure waveform and event simultaneously	2010
35	Ultrasonic flaw detector		Physical Acoustics Corporation (USA) ULTRAPAC	A, B and C scopes Tank size: 340 (H) x 400 (W) x 40 (dep) mm 5, 15, 20 MHz sensors	2008
36	Electrochemical test products (potentiostat/ galvanostat)		Princeton Applied Research (USA) VersaSTAT4-400	Max. control voltage: 10 V Voltage resolution: 6 μ V Current resolution: 122 fA Input impedance: 1 T Ω	2013
37	Polishing machine		Metkon Instruments Ltd. (Turkey) FORCIMAT	Rotate speed: 50 ~ 600 rpm Dimension: 230 x 430 x 250 mm Head speed: 50 ~ 150 rpm Number of sample holder: 6 units	2014

38	Carbon Coating machine		Vacuum Device	Sample Room:120φ×D120 mm, hard glass Sample Stage:100φ、 Source of evaporator 40m(up-down) Ultimate Vacuum:below 2Pa(1.5×10 ⁻² Torr) Vacuum Surveillance: up to 0.1Pa(7.5×10 ⁻⁴ Torr) Size = W300×D370×H436mm	2008
39	Electric densimeter		ALFA MIRAGE	Density Resolution: 0.001 g/cm ³ Scale Capacity: 0.001~300 g Measurable max. Size: 100(L)×70(W)×25(H) mm	2014
40	Small precision cutting machine		MARUTO Testing Machine Company TS-40	Max. cutting surface: round 30 x random length (mm) Square 60 (W) x random length x 25 (H) mm	2011
41	Laboplastmill		TOYO SEIKI Co., Ltd. 10C100	Roller-type mixer for a thermoplastic resin Rotation speed: 0.1-100 rpm Max. torque: 1000 N/m Max. temp.: 500 °C 2-axis low shear screw Kneading chamber 90 cc	2005
42	Heating and cooling hand press		SINTO Metal Industries Corporation YSR-10H/C	Output: 10-ton Board size: 225 x 225 mm Heating and cooling with 2-platen	2013
43	Heating and cooling hand press		TOYO SEIKI Co., Ltd. Mini TEST PRESS-10	Output: 10-ton Board size: 250 x 250 mm Heating and cooling with 1 platen Max. 300 °C	2004
44	Ultrasonic welder		Seidensha Electronics Co., Ltd.	<Oscillator> Max. output: 2400 W, Rated output: 2200 W Oscillating frequency: 19.15 kHz <Press> Welding pressure: 500-3400 N Max. air pressure: 0.7 MPPa Stroke: 100 mm	2013
45	Composite material cutting machine		MARUTO Testing Machine Company AC-500CF	Cutting size: 500 mm Auto-sending/ returning system Clamp mechanism by air cylinder	2010
46	Composite material cutting machine		MARUTO Testing Machine Company AC-500CF	Cutting size: 500 mm Auto-sending/ returning system Clamp mechanism by air cylinder	2016
47	Micro cutting machine		MEIWAFOFOSIS Co, Ltd. BS-310CP	Max. cutting surface: 190 x 150 mm Max. thickness: 0.04 x 40 mm Min. thickness: 2 μm CP method (Contact Point method)	2012
48	Universal testing machine		Simadzu Corporation AUTOGRAPH AG-Xplus	Loading capacity: 250 kN (25-ton) Loading Method: Direct high-precision constant speed strain control method via non-backlash ball screw drive Crosshead Speed Range: 0.0005-500 mm/min.	2011
49	Universal testing machine		Simadzu Corporation AUTOGRAPH AG-Xplus	Loading capacity: 100 kN (10-ton) Loading Method: Direct high-precision constant speed strain control method via non-backlash ball screw drive Crosshead Speed Range: 0.0005-1000 mm/min. Available thermostatic chamber	2013

50	Table-top precision universal tester		Simadzu Corporation AUTOGRAPH AGS-X	Loading capacity: 5 kN (500 kg) Loading Method: Direct high-precision constant speed strain control method via non-backlash ball screw drive Crosshead Speed Range: 0.0001-1000 mm/min. (stepless)	2011
51	Air Servo Fatigue & Endurance Testing Machine		Simadzu Corporation ADT-AV10Ks5	maximum Loading: ± 1.0 kN piston stroke: ± 2.5 mm control: Load,stroke compressor with air dryer(440L/min)	2015
52	Fatigue testing machine		MTS Systems Corporation Landmark	Loading capacity: 100 kN (10-ton) Shaker displacement: 150 mm (± 75 mm) Hydraulic wedge grips Available thermostatic chamber ($-40\sim 200$ °C)	2012
53	High-speed puncture impact tester		Simadzu Corporation HITS-P10	Testing machine capacity: 10 kN Hydraulic operation Max. speed: 20 m/s Available thermostatic chamber	2013
54	Drop-weight impact tester		INSTRON (USA) dynatup9250HV	Max. impact velocity: 20 m/sec. Energy range: 4.6--945 J	2004
55	Instrumented pendulum impact tester		INSTRON (USA) POE2000e	Max. capacity: 25.0 J Obtain energy absorption and load-displacement curve	2008
56	Creep testing machine		Shimadzu Access Corporation	Max. load capacity: 1000 N Available thermostatic chamber	2011
57	7.5 kW super Xenon weather meter		Suga Test Instruments Co., Ltd.	7.5 kW Radiation intensity: 180 W/m ³	2013
58	3D ultrasonic inspection system		TOSHIBA POWER SYSTEMS INSPECTION SERVICE Co., Ltd. MatrixeyeEX	Easy-to-carry portable system sampling frequency: 10, 20, 40, 80, 100 MHz (12-bit) Frequency range: 2-15 MHz Gain setting: 0-80 dB	2012
59	Modal analysis		TOYO Corporation	with FFT analyzeOR34, Impact hammer086D20, Miniature hammer assembly 086E80, accelerometer ICP, connector cable small & light (1.5 kg), dynamic range 125 dB, 40 kHzFFT analyzer Simultaneous FFT, octave and tracking analysis	2013
60	Small high voltage power supply/ CR electrode		Green-Techno GT100P	Experiment instrument of lightning resistance Max. output voltage: 10 kV	2009
61	Heating and cooling auto press		PEI (France)	Auto double-acting heating and cooling press Output: 30-ton Board size: 500 x 500 mm Heating and cooling with 1 platen temp. accuracy: 200 °C: R4.3 °C 400 °C: R7.5 °C The heat plate divided into 9 are controlled independently Automatic operation program	2011

62	CF sheet heating system		NGK INSULATORS, Ltd.	Infrared heater Each of 3 points at the top and bottom can be controlled independently Effective heating area: 300 x0 400 x 100 mm Heater temp.: Max. 400 °C with Air Blow	2013
63	Hand truder		TOYO SEIKI Co., Ltd. Hand Truder PM-1	Manual injection molding machine Manufacture pellets also Furnace temp: 20-400 °C Cylinder size: Φ 12 x 130 mm Sample capacity: 9 cc	2011
64	Vacuum drying machine		ADVANTEC Vaccum drying machine body: DRV320A COLD TRAP DRT140FB	Inner dimension: 290 (H) x 300(W) x 300 (dep) mm Temp. rising time: 50 °C ~ 2500 °C Vacuum degree: 100 ~ 0.13 kPa	Before 2008
65	Notching machine		YASUDA SEIKI SEISAKUSHO Ltd. 189-PN	Notching tool for notch-process to Charpy-Izot impact test speciment Cutting rotational speed: approx. 500 rpm (50 Hz)	2008
66	Laser scanning microscope		KEYENCE Corporation VK-8510	Height measurement: 7 mm Resolution of height: 0.01 μm Resolution of horizontal: 0.01 μm	2004
67	HyperWorks		Altair	Interactive high function Preprocessor <RADIOSS> Linear/ Non-linear finite element solver <HyperForm> Synthesis press molding framework	2011
68	HEEDS		JSOL	Multidisciplinary design optimization software Capable of the sutomatic research of the design parameter using the original oprimization algorithm Capable of cooperation calculation with general-purpose software	2014
69	GENOA		ADTEC	Analysis software of damage progress and failure evaluation for composite material By multi-scale method, enable to simulate damage progress	2015
70	DIGMAT		MSC Software	Calculator software for linear/ non-linear composite material By multi-scale structural analysis technique, grasp the behavior and mechanism of composite materials	2014 + 2015
71	LS-DYNA		JSOL	Shockanalytical software of dynamic explicit method JVISION (pre-and post- processor having high affinity with LS-DYNA)	Before 2008
72	Moldex3D		JSOL	Flow molding software By compression molding module, enable to simulate press molding of FRP	2015
73	Abaqus		Dassault SIMULIA	General finite element program; heat transfer analysis and structural analysis of advanced contents Preprocessor (AbaqusCAE) capable of modeling, job management, monitoring of analysis, display of result	2015