Materials, Design & Manufacturing Facility (CWB)
材料、設計和製造中心（清水灣）

MDMF (CWB)

Introduction
Our Services – 5 Units

CAD/CAM/CAE (CAD)

Development Studio (DS)

Materials Services (MAT)

Electrical & Mechanical Fabrication (EMF)

Instrumentation, Maintenance & Repair (IMR)
Services Scope – EMF

- Engineering design and fabrication supporting services
- Sophisticated mechanical & electrical parts/equipment for the university and industrial collaboration projects
  - Parts/equipment/controller is not available in market
  - Multidisciplinary and application oriented activities
Services Scope – EMF

05/Mar/2024

MDMF (CWB)
Services Scope – DS

- Controller design and fabrication supporting
  - Controller boards, MCUs, cam, motors, sensors (environmental, motion, light, etc.)
  - Eclipse for android development, Arduino IDE, Raspberry Pi, PLC
  - PCB prototyping
Services Scope - IMR

• Repair and maintenance of equipment
  – Scientific instruments, computer control machineries, laboratory equipment, and electrical safety
  – Especially for those which are no longer supported by the manufacturers

• Calibrations for multimeter, power meter, data logger, radiation monitor and temperature sensors
Services Scope - IMR

IMR Services
Materials, Design and Manufacturing Facility (CWB)

MDMF (CWB)
Services Scope - CAD

- Nano-measurement
  - Nano indenter, 3D surface metrology, optical profiler, contact angle meter
Services Scope - CAD

- Metal, Nylon & Plastics - 3D printing, Laser cutting

Metal 3D Printer

Nylon 3D Printer

05/Mar/2024

Plastics 3D Printer – Filaments FDM

Plastics 3D Printer – Resin SLA

MDMF (CWB)

Metal & Plastics Laser Cutting
Services Scope - CAD

- CAD/CAM/CAE system support, 5-axis metrology, 3D scanning, reverse engineering
Services Scope - MAT

- Mechanical Testing
  - also known as destructive testing, reveals the properties of a material under dynamic or static force

MTS 810
5KN to 100KN

MTS 858
15kN Axial and 100 Nm Torsion

MTS 858 Mini Bionix
25KN Axial, 250 Nm Torsional
Services Scope - MAT

- Inspection and Failure Analysis
  - determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

X Ray inspection system: GE
Detail Detectability: up to 0.2µm
Max. Voxel Resolution: < 1µm
Max. Object Size: 680mm x 635mm

X Ray with CT imaging inspection system: yxlon Cougar EVO
Detail Detectability: < 0.75µm
Spatial Resolution: 1.5µm
Max. Object Size: 440mm x 540mm
Services Scope - MAT

- Inspection and Failure Analysis
  - determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

Zeta Potential / Nano-particle Analyzer: ZetaPlus
Zeta Potential Range: -150 to +150 mV
Size Range: 10nm to 30µm

TecScan 7 Axis Immersion Scanner
1600mm x 800mm x 800mm sample length

C-SAM: Sonix Quantum 350H
Spatial resolution: 0.5 µm
Depth resolution: 8 µm

05/Mar/2024

MDMF (CWB)
Services Scope - MAT

- Inspection and Failure Analysis
  - determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

Particle Size Analyzer
Measurement capability from 0.01 to 2800 microns

Microscope: Topcon TMM-13OZ
Measuring range: 130 x 130 x 50 mm
Minimum indication: 0.001 mm
Accuracy: (3 + 2.5L/100) µm

Image Processing System
Leica QUANTIMET 500+
Services Scope - MAT

- Sample Processing
  - processing of metal heat treatment, polymer and carbon composite

- Reactive Ion Etching System
- Centrifuge Z 326
- Ultracut & Ultramicrotome and EM FCR
- Diamond Precision Saw
- Misonix XL2020 Sonicator
- Hot Melt Prepregger
- Oven: Heating and Drying
- Autoclave
- Hydraulic Hot Press
- Furnace
- Humidity Chamber
- MDMF (CW)
Project – Metal Laser Cutting

- Fiber laser cutting machine of 1.5kW
  - Working area: 630 x 530 x 90 mm
  - 4th rotary axis for round pipe cutting

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild Steel</td>
<td>0.2 ~ 16</td>
</tr>
<tr>
<td>Stainless Steel</td>
<td>0.2 ~ 8</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.5 ~ 5</td>
</tr>
<tr>
<td>Copper</td>
<td>0.5 ~ 2</td>
</tr>
<tr>
<td>Brass</td>
<td>0.5 ~ 4</td>
</tr>
</tbody>
</table>
Project – Metal Laser Cutting

• Examples
  – SMA specimens
  – Tensile specimen:
    – Materials / Thickness: 1mm
    – Production time: 45 second
  – Crack specimen:
    – Materials / Thickness: 1.5mm
    – Production time: 1 min.
  – S.S. Filter specimen
    – Materials / Thickness: 1.2mm
    – Production time: 8min. 30 second
  – Ti Electrode specimen
    – Materials / Thickness: 1mm
    – Production time: 2min.
Project – Laser Marking & Engraving

- Laser Marking Machine
  - 10W fiber laser
  - Max. size is 110mm X 110mm
Project – Ultrasonic-Assisted Machining

- Ultrasonic tool holder
  - Fast, small and deep hole machining
  - Length / Diameter > 10
  - Hard or ultra-hard material cutting
  - Glass, Ceramics, Vulcanization silicon, etc.
  - Stainless steel, Tungsten steel, Molybdenum, etc.
Project – Ultrasonic-Assisted Machining

• Examples
  – Alumina, Small hole drilling / milling (blind hole)
    • Hole diameter = 1.2mm; depth = 1.4mm
    • # of holes to be drilled per workpiece = 400
Project – Ultrasonic-Assisted Machining

• Examples
  – Glass, Small hole drilling (thru’ hole)
    • Hole diameter = 0.6mm; Glass plate thickness = 1mm
    • # of holes to be drilled per workpiece = 4

Smooth edge boundary
Project – Ultrasonic-Assisted Machining

• Examples
  – Glass channel, Small hole drilling (thru’ hole)
    • Hole diameter = 1.0mm; depth = 1mm
    • # of holes to be drilled per workpiece = 3

05/Mar/2024
MDMF (CWB)
Project – Ultrasonic-Assisted Machining

• Examples
  – Stainless steel, Small hole drilling (blind hole)
    • Hole diameter = 0.2mm and 0.9mm
    • Depth = 5mm and 20mm
  – SMA Shape Memory Alloy, Small hole drilling (thru’ hole)
    • Hole diameter = 0.075m
    • Thickness = 2mm
Project – Metal 3d Printing

- **Metal 3D printer – DMP Flex100**
  - Build volume 100 x 100 x 80 mm
  - Layer thickness: 10 ~ 100 μm
  - Typical accuracy: ± 0.1-0.2% with ± 50 μm minimum
  - Supported materials:
    - LaserForm 316L (B)
    - LaserForm 17-4PH (B)
    - LaserForm CoCr (B)
Project – Nylon 3d Printing

- Nylon 3D printer – HP Jet Fusion 540
  - Build volume 332 x 190 x 248 mm
  - Layer thickness: 0.08 mm
  - Typical accuracy: ± 0.3% with ± 0.2 mm minimum
  - Supported materials:
    - Nylon PA12
Project – Industrial SLA 3D Printing

- Industrial SLA 3D printer – J850 PRIME
  - Build volume 490 x 390 x 200 mm
  - Layer Thickness: down to 14 μm
  - File Formats for Printing:
    - Color and Texture: 3MF / OBJ / SolidWorks / VRML
    - Color: CATIA / Creo / Inventor / IGES / JT / Parasolid / NX / SolidEdge / STEP
    - None: STL
  - Accuracy:
    - Under 100 mm – ±100μ
    - Above 100 mm – ±200μ or ± 0.06% of part length, whichever is greater
  - Digital model materials: Unlimited number of composite materials including:
    - Over 600,000 colors with VeroUltra
    - Rubber-like materials in a variety of Shore A values
    - Translucent color tints
Project – Desktop SLA 3d Printing

- Desktop SLA 3D printer – Form 2
  - Build volume 145 x 145 x 175 mm
  - Layer Thickness 0.025 - 0.1 mm
  - File Formats for Printing: STL, OBJ
  - Professional print quality
Project – Desktop SLA 3d Printing

- Desktop SLA 3D printer – Form 3L
  - Build volume 335 x 200 x 300 mm
  - Layer Thickness 0.025 - 0.3 mm
  - File Formats for Printing: STL, OBJ
  - Low Force Stereolithography (LFS)™
Project – Desktop SLA 3d Printing

- Examples
  - Blood vessel
    - Materials – Standard White
    - Minimum feature size = 0.5mm
Project – Desktop SLA 3d Printing

- Water channel model
  - Materials – Standard Clear
  - Channel size = 2.5mm
  - Internal water circulation
Project – High Vacuum Chamber

- High vacuum stainless steel chamber
  - Design and build an enhanced HVC with tailor made functionalities
  - Vacuum level less than $10^{-8}$ torr
Project – Reactive Ion Etcher

- Design and build the reactive ion etcher in wafer fabrication
  - Tailor made functionalities
Project – Soil Retaining Gate

• Design and build the soil retaining gate of a flume model

05/Mar/2024

MDMF (CWB)

The Hong Kong University of Science and Technology
Project – Shaking Platform

- Design and build the shaking platform for
  - Active vibration control of earthquake / wind excited structures
  - Assessment of motion acceptance criteria for human occupancy in the design of flexible structures
Project – Automatic Flaws Inspection System

- To automate the detection process of natural and manufacturing flaws before/after laser cutting a plywood board.
Project – Automatic Flaws Inspection System

~11,500mm

~3,000mm

PreIES-1 Workstation
PreIES-2 Workstation

Belt-in PreIES-1
Belt-in PreIES-2

Belt-out Flipper

Belt-out Prn

PreIES-1
PreIES-2
Flipper

05/Mar/2024
MDMF (CWB)
Project – CIPP Repair Robot Cutter

- To develop an automatic robot cutter that can cut the lateral connection branch opening during underground drainage pipe repairing in Hong Kong.
Project – Diamond Sorter

- An automation system to sort gems into different size / color / shape / transparency grades and to measure the cutting / cracks on diamonds
  - Involves the R&D of a vision system, image processing module and an electromechanical mechanism
Project – Feather Sorter

• To sort feathers of different features for the shuttlecock manufacturing industry.
  – Involves the R&D of a turning table, an image processing system and a robotic arm, which selects feather into the bin matrix according to their degree of curvature
Project – Controller for Embroidery Machine

• Design and develop a controller to control the embroidery machine more precisely and at higher speed, with less vibration
  - Linux in an embedded system, with advanced control algorithms for accurate positioning, tension control, automatic compensation of vibration
Engineering / Robotic Design Competition

- RoboCon
- ROV
- Cybathlon
- Pedal Kart
- Power Bike
- ...

05/Mar/2024
MDMF (CWB)

The Hong Kong University of Science and Technology