CMTI

Technology Profile

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CENTRAL MANUFACTURING TECHNOLOGY INSTITUTE

CMTI

Technology Profile

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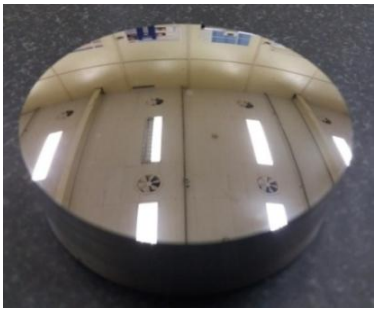
Ultra Precision Turning Machine

Nanoshape T250



Salient Features:

- High Stiff Hydrostatic Oil Bearing Slides
- Ultra Precise Aerostatic Spindle
- Natural Granite Bed with Vibration Isolation System and active leveling
- Independent Slide configuration
- Open Architecture Motion Controller with Adaptive Control Technology
- Integrated chiller for Thermally stable slides and spindle

Specification:

• Number of Axis :	3 Axis (X & Z, C-Axis)
• Maximum Workpiece Size:	Dia.: 250 mm, length:150 mm
• Spindle Running Accuracy :	≤ 25nm
• Work Holding Spindle Max. Speed:	8,000 RPM
• Positional accuracy :	≤ 0.3µm
• Straightness of Slides :	≤ 0.3µm
Workpiece accuracies	
• 75mm dia convex (ROC-250mm):	AL 6061 T6 alloy
• Surface Roughness (Ra) , micrometer:	< 2 nm
• Form Accuracy(P-V):	< 0.2µm
• Hardened Steell	60 HRC
• Surface Roughness (Ra):	<14 nm

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Ultra Precision Turning Machine

Nanoshape T250

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Standard materials commonly used for engineering product development, such as various categories of steel alloys, aluminum alloy, natural granite, etc. Standard components include workhead spindle, linear motors and drives, linear scale, micrometer, Vibration isolation system, hydraulic power pack, hydraulic valves, diamond tools, water chiller, air dryer systems, structural frames other mechanical & electrical elements

Major Plant Equipment and Machines required

- Ultra-precision micro machining Center, Wire cut EDM, Precision Turning and Milling Machine Precision Grinding Machine, Laser interferometer, Ultra precision dimension, form and surface roughness equipments

Techno economics :

- In India, these technologies are in huge demand for strategic sectors and other non strategic Industrial sectors. However, all the SPDT machines are being imported and large amount of high value machined components are being outsourced from abroad. No machine tool builder in India is building these machines and there are very few industries fabricating the diamond turn components in our country.

Technology Package:

- One set of all assembly drawings for the prototype in the form of reproducible on tracing sheets.
- One set of Mechanical component drawings.
- One set of Electrical Drawings.
- One set of test charts.
- Consultancy in developmental activities related to machine building of Nanoshape T250.
- Consultancy in process parameters and process developmental activities.
- One set of achieved test results.

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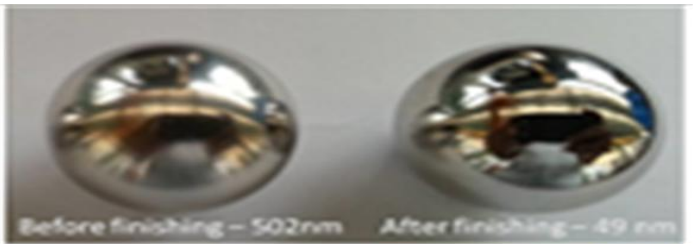
Abrasive Flow Finishing Machine (AFFM-150D)



Salient Features:

- Finish / deburr ID and OD of components.
- Radiusing of sharp edges.
- Finishes inaccessible areas & complex internal passages .
- Temperature control of abrasive laden polymer media.

Specification:

- Height of the component: 10 to 300mm
- Hydraulic Pressure Range: 15 to 100 bar
- Media Cylinder Bore Diameter : 150 mm
- Media Piston Stroke :250 mm
- Media : Visco elastic abrasive laden polymer
- Controller: Mini PLC- HMI Based

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Standard common materials
- Standard hydraulic components like actuators, power pack system, connecters etc.
- Standard electrical components like sensors, PLC controllers, HMI units, electrical etc.
- Visco-elastic abrasive polymer material.

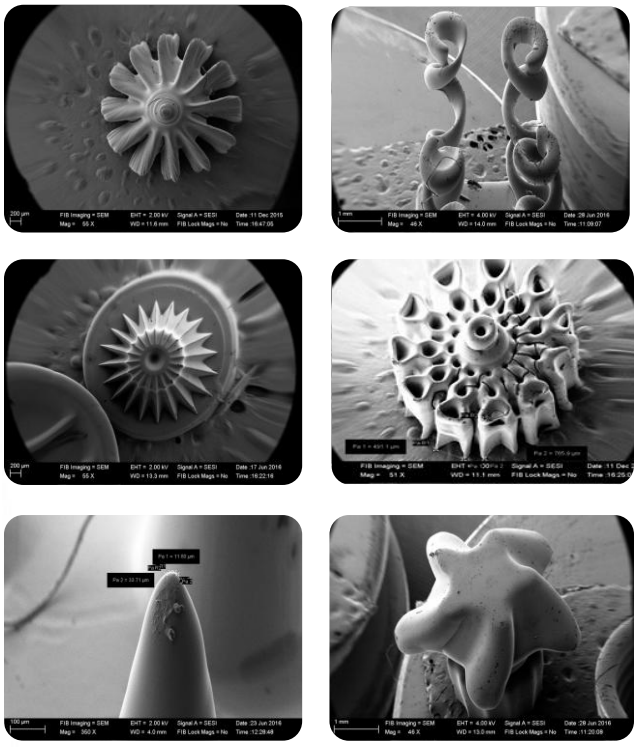
Major Plant Equipment and Machines required :

- General purpose manuafacturing facilities like lathe, Milling and grinding etc.,

Techno economics :

- Potential exists for finishing of complex and intricate shapes. Its an indigenous product highly competitive with imported machine

SUKSHM 3D Microfabrication System



Fabricated Micro 3D Components

Salient Features:

- The revolutionary micro-fabrication system enables complex 3D ultra fine solids to be made in a short time by means of spatial light modulation technique.
- A UV-curable resin having a hitherto unachieved resolution is cured at a super-precision resolution by a high-precision digital light exposure mechanism.
- 3-D structures are created by the layer-by-layer forming method, under which 3-D ultra-fine solids are formed automatically by repeated light exposure and resin coating.
- Ultra-fine Features down to 10 µm level cab be fabricated
- Layer thickness can be optimized to 5µm level so that staircase effect can be eliminated with continuous exposer of UV projection.

SUKSHM 3D Microfabrication System

Technical Specifications:

- Minimum feature size: <10µm
- Maximum print size: 14X8X25mm
- Layer thickness: 5um to 100µm
- Z axis accuracy: 1µm
- Clean room class: 100000
- Ambient Temparature: 25^0 C +/- 2^0 C

Level of Development: TRL 6

Status of Commercialization :

- Ready for Technology Transfer & Commercialization.

Major Raw materials to be Utilised :

- Aluminium for fixtures and sheet metal for enclosure Vibration isolation system Linear slide and DMD DLP light engine with suitable optical components.

Major Plant Equipment and Machines required:

- CNC milling machine and a turning centre, Grinding machine, Clean room class 1,00,000 with compressed air supply for assembly and process validation. Clean bench for rinsing the micro parts
- Precision measurements systems like optical microscope and laser-based CNC stage inspection systems, Characterization facility for process validation.

Techno economics:

- In India, polymer based micro 3D printing is an emerging technology. Currently macro 3D printers are widely available around the globe but micro 3D fabrication technologies are not avaialbe due to complexity of process and high development cost. CMTI is only the technology developer in India for polymer based microfabrication to cater various industry needs. The SUKSHM 3D microfacation system can realise the complex micro parts at very low opertaion and mainatanace cost

Technology Package:

- GUI & control software, Mechanical and electrical drawings.
- Fabrication parameters for general purpose resins and biocompatible resins.
- To provide consultancy in developmental activities related to machine building of SUKSHM 3D.
- To provide consultancy in process parameters and process developmental activities.

Centerless Bar Turning Machine (TBC-36)

Salient Features:

- Bar peeling operation on hard materials like Titanium alloy/Super- alloy/ special alloys
- Rough and finish turning in one pass

Specification:

- Diameter of Black Bar: 12 - 38 mm
- Bar Length: 2000 - 4000 mm
- Depth of cut: 0.5 mm to 2.5 mm
- Tolerance of the Turned Bar : ISO h9
- Ovality on Turned Bar: 0.020 mm or less
- Surface finish on Turned Bar : 0.8 µ
- Spindle Speeds: 200 to 1000 rpm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O- Rings, Circlips, Fasteners, bellows, Slideway liner material etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

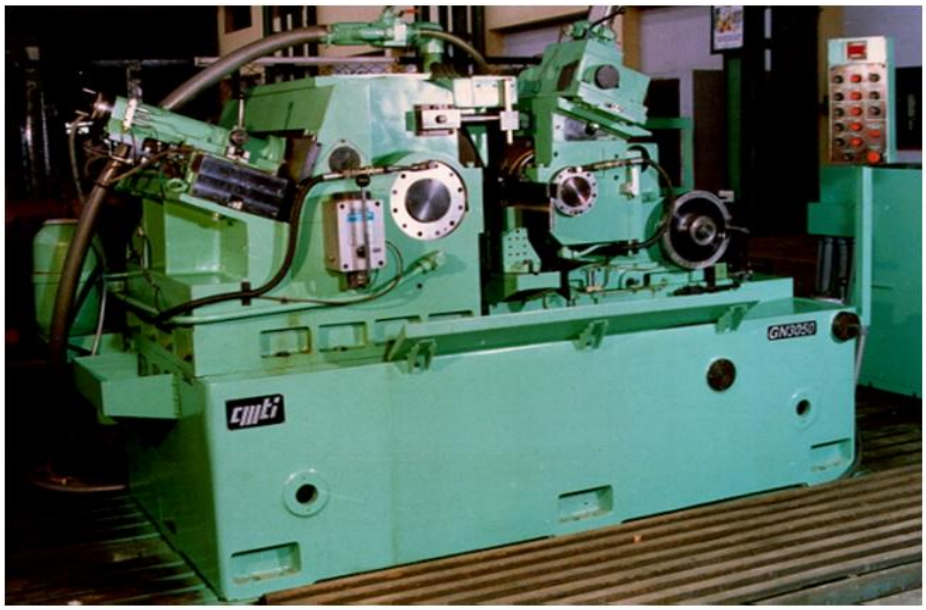
Techno economics :

- TBC-36 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Centerless Grinding Machine (GN-3050)



Salient Features:

- Centreless grinding machine is designed mainly for through feed grinding, however, the machine can be converted easily suitable for plunge grinding or CNC version

Specification:

- Workpiece dia: Ø8.5 mm to Ø150mm
- Grinding wheel Ø610 mm, width: 508 mm
- Regulating wheeldia:355.6mm,width: 508mm
- Lower Slide travel: 175 mm
- Upper slide travel: 226 mm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O-Rings, Circlips, Slideway liner material, Hydromotor, Safety coupling, Disc brake, Grinding & regulating wheel, Librication unit,etc etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- GN-3050 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Facing and Taper Boring Machine (FTB-320)

Salient Features:

- Portable Machine
- For Facing & Boring and taper boring of large dia. Jobs

Specification:

- Turning Range: 2000 mm to 3200 mm
- Speed of the Swivel arm:4 - 20 rpm
- Face slide traverse (radial): 300 mm
- Boring slide traverse (axial): 125 mm
- Swivel angle range: +/- 30 degrees
- Feed
    - Facing: 0.1 – 0.5 mm/rev
    - Boring: 0.1 – 0.5 mm/rev

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O-Rings, Circlips, Fasteners, bellows, Slideway liner material etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- FTB-320 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Line Boring Machine (LBM)

Salient Features:

- Portable Machine, For in-situ heavy duty Boring and Facing of horizontal bores

Specification:

- Permissible Boring Diameters: Ø650 mm to Ø740mm
- Permissible Facing Diameters: Ø500 mm to Ø900mm
- Max cutting depth: Boring 3mm, facing 2 mm
- Boring Bar diameter: 360 mm
- Speed range: 6.3, 9, 12.5, 16 rpm
- Quill feed: 150 mm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O-Rings, Circlips, Slideway liner material, Hydromotor, Safety coupling, Disc brake, Grinding & regulating wheel, Librication unit,etc etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- LBM is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Universal Cylindrical Grinding Machine (UGC-260)

Salient Features:

- Designed with considerable care to achieve a very high degree of accuracy of roundness and cylindricity on jobs and is suitable for cylindrical, face and internal grinding operations

Specification:

- Center Distance: 1000 mm
- Center Height: 130 mm
- Table traverse speed: 0.05 - 50 mm/min
- Max traverse 1050 mm
- Max swivel: -2 to +8 deg
- Grinding Wheel: 400 x 50 x 127 mm
- Spindle Speeds: 1800 to 2400 rpm
- Quill travel: 25 mm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O-Rings, Circlips, Slideway liner material, Hydromotor, Safety coupling, Disc brake, Grinding & regulating wheel, Librication unit,etc etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- UGC-260 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Finish Turning Machine (TGPR-CNC)

Specification:

1. Machining range

- OD (Min) : 70 mm
- OD (Max): 160 mm
- Chucking width (Max.): 25.4 mm

2. Spindle

- Speeds (step-less): 100 to 400rpm
- Motor: AC 7.5 kW (10 HP)

Salient Features:

- Special purpose automatic CNC machine for performing machining operations such as finish turning, grooving and chamfering on outside diameter of piston rings.

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc. Standard components includes Motor, Electrical control elements, Bearings, O-Rings, Circlips, Fasteners, ballscrews, Poly V-belts etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, etc.,

Techno economics :

- TGPR CNC is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials.

Facing and Boring Machine (FB-50)

Salient Features:

- Portable Machine

Specification:

- Facing range : Ø200mm to Ø900mm
- Boring range : Ø130mm to Ø500mm
- Facing spindle Speed: 10 - 30 rpm
- Boring spindle speed: 10 - 90 rpm
- Face slide travel : 250 mm
- Vertical movement of Tool slide: 50 mm
- Boring spindle traverse: 650 mm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as Ferrous & non ferrous materials etc. Standard components like Motor, Electrical control elements, Bearings,O-Rings, Circlips, Fasteners,ballscrews,Poly V beltsetc., bearings,O-Rings, Circlips, Fasteners, bellows, Slideway liner material etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- FB-50 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

CNC Keystone Piston Ring Grinding Machine (GKPR-CNC)

Specification:

- Max. work-piece dia: 200 mm
- Max. O.D.of Magnetic chuck: 200 mm
- Wheel head table stroke max: 480 mm
- Work head swivelling angle: +/-15deg
- Work spindle speed: 200 rpm

Salient Features:

- Max. Work-piece dia.: 200mm
- Max OD of magnetic Chuck: 200 mm

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.

- Standard materials commonly used such as Ferrous & non ferrous materials etc. Standard components like Motor, Electrical control elements, Bearings,O-Rings, Circlips, Fasteners,ballscrews,Poly V belts etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

Techno economics :

- GKPR-CNC is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

Ultra Stiff Ultra Precision Hydrostatic Slide

Model & type	HS200; Fully constrained oil hydrostatic, box way slide
Travel	200 mm (8 Inch)
Load capacity & stiffness	1000Kg (10,000 N) 1000N/µm
Drive system	Brushless DC Linear Motor
Feedback type	Ultra precision Glass Scale
Feedback resolution	32 Pico meter
Straightness	Horizontal :0.2 µm over full travel, Vertical : 0.4 µm over full travel
Feedrate (working)	Upto 1000 mm/min

Salient Features:

- Hydrostatic oil Bearing with theoretical infinite lifetime
- True motion, zero stick-slip, zero backlash & Maximum positioning accuracy
- High stiffness for Heavy loads & excellent geometric performance
- High Dampening effect from oil film for vibration from machining process
- Thermally stable, with heat dissipation by oil & additional water cooling
- Direct drive with Integrated Linear motor with low cogging force
- Ultra precision Linear Glass Scale for position feedback
- Integral high performance bellows for protection of Bearing & electronics from Contamination

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Standard materials commonly used for engineering product development, such as various categories of steel alloys, aluminum alloy, granite, etc.
- Standard components include linear motors and drives, Linear scale, micrometer, power pack, hydraulic valves, other mechanical & electrical elements

Ultra Stiff Ultra Precision Hydrostatic Slide

Major Plant Equipment and Machines required

- Ultra-precision micro machining Center, Wire cut EDM, Precision Turning and Milling Machine, Precision Grinding Machine, Laser interferometer, Ultra precision dimension, form and surface roughness equipments

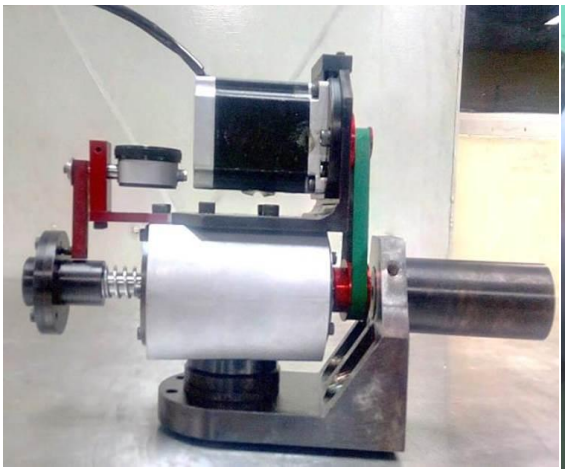
Techno economics :

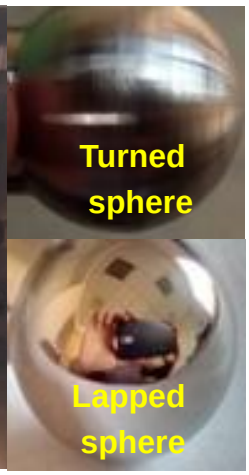
- No Indian Machine tool manufacturer offers hydrostatic slides as commercial elements and neither machine tool with integrated hydrostatic slides.

Technology Package:

- One set of all assembly/integration drawings for the prototype in the form of reproducible on tracing sheets.
- One set of Mechanical component drawings for manufacturing.
- One set of Electrical Drawings.
- One set of test charts
- One set of operation and user's guide manual
- To provide consultancy in activities related to development.
- One set of achieved test results

Sphere Lapping Attachment for CNC Lathe





Salient Features:

- Attachment for CNC lathe, easy to mount on VDI 30 or VDI 40 turret, Turned sphere balls are lapped, Sphere to be lapped is being held in machine spindle.

Status of Commercialization:

- Ready for Technology Transfer

Level of Development :

- Quality wise attachment can provide the output of form (sphericity) less than 0.008 mm and surface roughness value (Ra) less than 0.03 micrometer

Major Raw Materials to be Utilized:

- Generally cast Iron tool and for finishing process standard felt. Process uses lapping paste with different grades.

Major Plant Equipment and Machines required:

- CNC lathe and Electric power to run its motor drive.

Techno economics:

- It is unique attachement for CNC lathe.
- Attachment used to produce finishing process on spherical balls.
- Attachment is economical.
- Form and surface finish achieved is in micrometer level.

Technology Package:

- Design and drawings, technical document, consumable details and bill of materials

Tilt & Turn Table (TTT-4)

Specification

Turn table diameter:	450mm
Total height in horizontal position:	420mm
Height of tilting axis:	260mm
Tilting Range / Accuracy:	0-90˚ /±10 sec
Rotation Range / Accuracy:	0-360˚ /± 5 sec
Parallelism of table surface:	0.015 mm
Faceplate wobble:	0.010 mm
Run out of centre bore, TIR:	0.010 mm

Salient Features:

- Tilt & Turn table is a 2 axis manually operated unit & is a table top mounted unit, compact in size, with high precision positioning accuracies.

Level of Development :

- Machine developed, tested & supplied to customer

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Standard materials commonly used such as various categories of steels, rubber, phospho bronze, Ferrous & non ferrous etc.
- Standard components includes Motor, Electrical control elements, Bearings,O-Rings, Circlips, Fasteners, bellows, Slideway liner material etc.,

Major Plant Equipment and Machines required :

- Fabrication facility, Work handling facilities & Assembly toolings.
- General purpose manufacturing workshop equipments like, Turning, Drilling, Boring, Milling, Grinding Machine, Standard pipe bending machine and other.

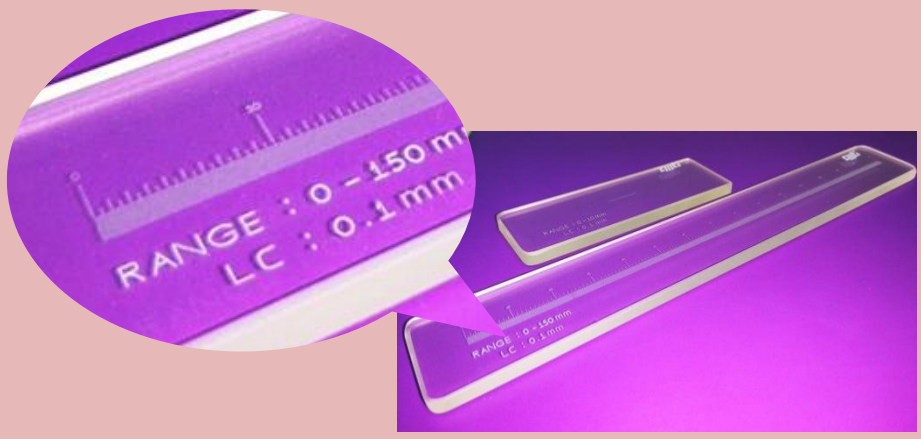
Techno economics :

- TTT-45 is special purpose machine used for specific applications and does not require techno-economic study

Technology Package:

- Design & Drawings, Technical documents, Bill of Materials

High Precision Optical Standard Glass Scales



Salient Features:

- Gratings accuracy within 2 µm.
- Substitute for import items.
- Supplied with calibration certificate under NABL accreditation.

Specification:

- Graduation pitch: 10 to 100 µm
- Graduation thickness: 2 to 12 µm

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Double side polished Borosilicate, BK7, Soda lime etc

Major Plant Equipment and Machines required :

- High Precision Ultra Fast Pulsed Laser Micro Machining System
- High resolution optical microscope
- High Accuracy Video Measuring System

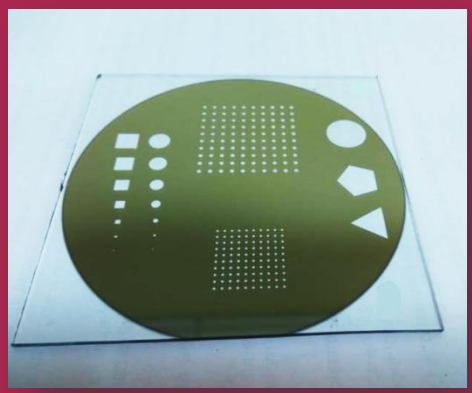
Techno economics :

- Indegeneous development of technology and having high potential in commercialization of artefacts development.
- The cost of the standard glass scales will be 1/10th of the imported cost and the standard glass scales will be supplied with accredited calibration certificate on par with international standards.

Technology Package:

- Process Technology for Laser machining & Calibration Protocol.

High Precision Optical Calibration Masks



Salient Features:

- Calibration of Imaging, Optical and Microscopy equipments etc.
- Substitute for import items.
- Coatings: Chrome (bright & anti-reflective), aluminum, Iron oxide etc

Specification:

- Size varies from 0.3”x0.3” to 8”x 8”
- Feature to feature accuracy down to 1 µm

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Double side polished Borosilicate, BK7, Soda lime, fused silica and quartz.

Major Plant Equipment and Machines required :

- High Precision Pulsed UV Laser Micromachining System
- Thin film coating system
- High resolution optical microscope

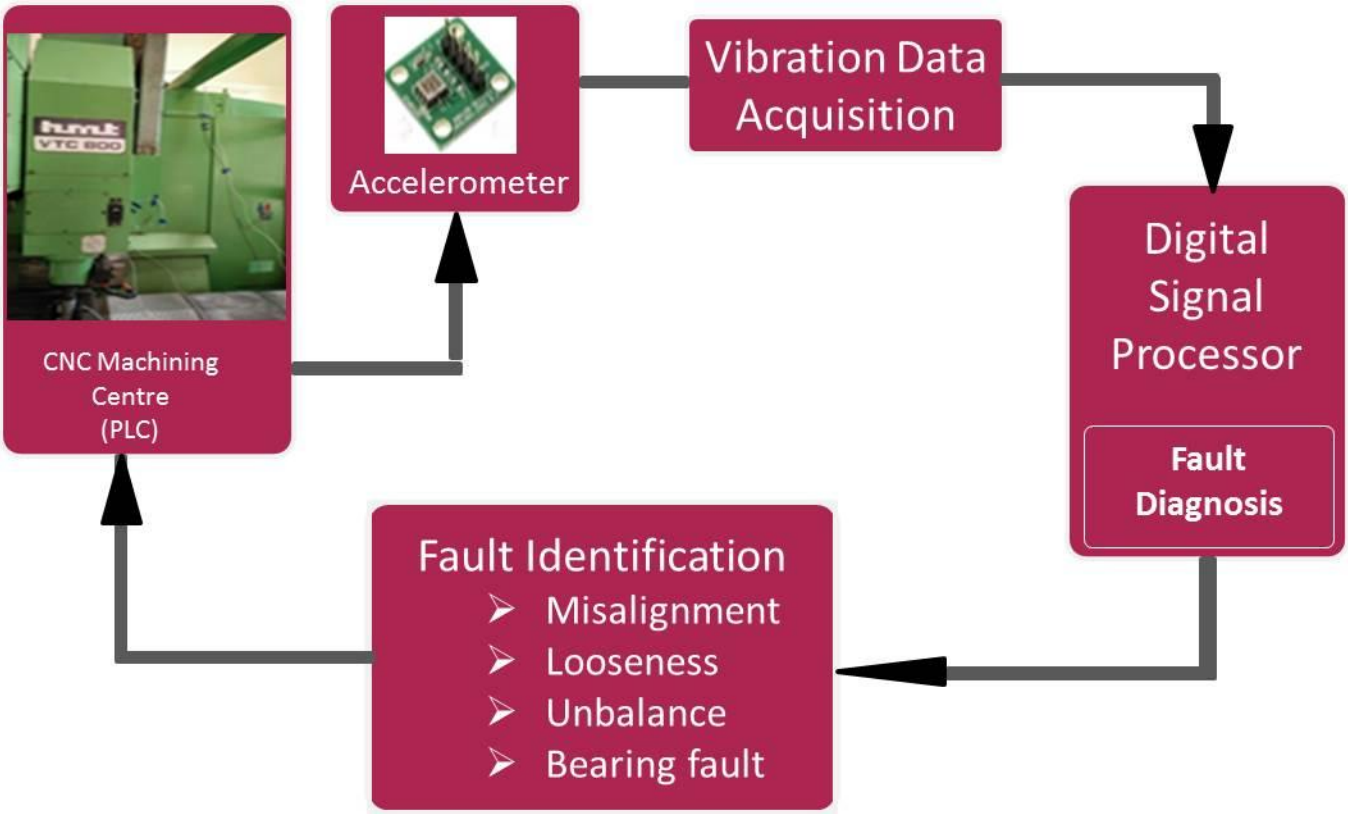
Techno economics :

- Indegeneous development of technology and having high potential in commercialization of artefacts development.
- Thin cost of the calibration masks will be 1/10th of the cost of imported mask with same accuracy.

Technology Package:

- Design of Mask, Process Technology for Laser Machining, Thin film coating technology.

Machine Health Management System
Machine Fault Diagnosis Module



Salient Features:

- Machine tool vibration measurement
- Fault diagnosis for Unbalance, Misalignment, Mechanical looseness and Bearing
- Determine both the nature and severity of the defect
- Predict the machine's useful life or failure point

Technical Specifications:

- MEMS Accelerometer Range: ±16g
- SPI Interface
- TMS320C5535 DSP Controller

Level of Development :

- TRL 6

Status of Commercialization:

- Ready for Feasibility Study and Technology Transfer

Major materials Utilised :

- Standard acclerometers
- Standard digital signal processor.
- Standard mounting fixtures, electrical cables, signal cables, calbrator etc.

Techno Economics :

- By measuring and analysing the vibration of a machine, it is possible to determine both the nature and severity of the defect, and hence predict the machine's useful life or failure point.

Technology Package:

- Design, Technical documents, Bill of Materials

Diamond Like Carbon

by Surface Engineering

Kavach DLC

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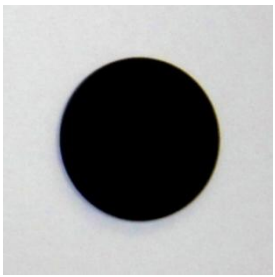
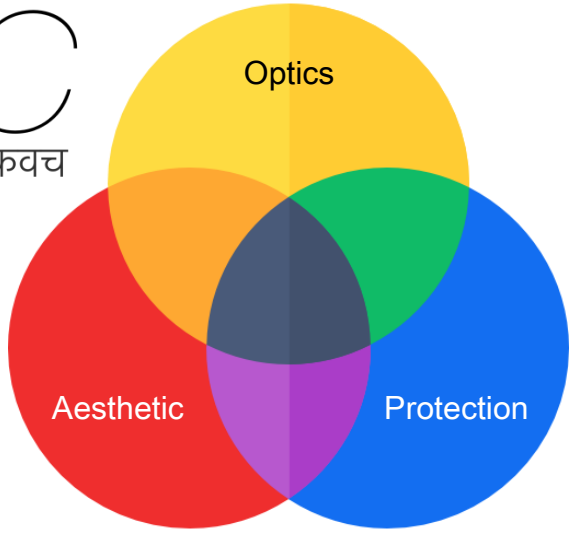


Germanium Optics

Surgical Blade



Salient Features:

- Customised process solution
- Provide adhesion solutions
- Provide process implementation

Specification:

- Hardness: >2500 HV
- IR Transmission: >90%
- COF: 0.05

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- C_2H_2, O_2, N_2, Ar, H_2 & CH_4 gases required

Major Plant Equipment and Machines required :

- PECVD

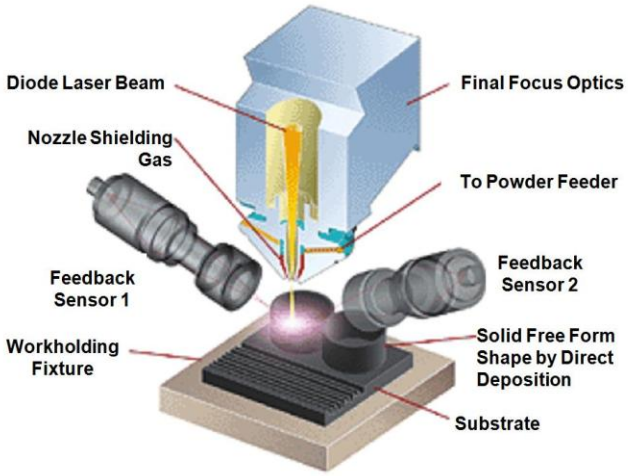
Techno economics :

- Feasibility study for customised applications of DLC process on any material at low cost.
- Indigenisation of process for hard & optical coatings.
- Consultancy will be provided for selection of the equipment and optimizing process for mass production.

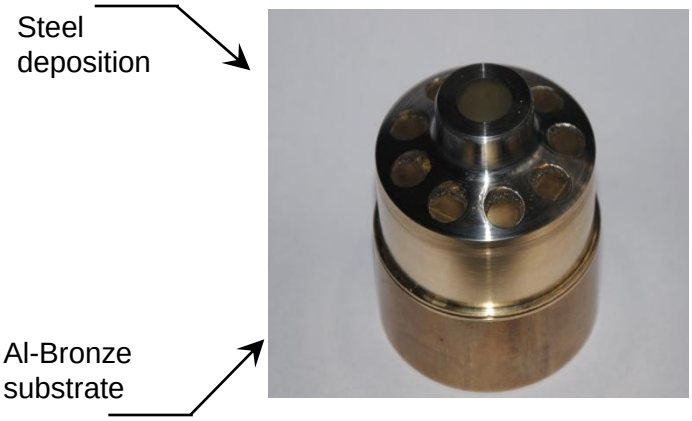
Technology Package:

- Process Customisation and Process Optimisation

Additive Manufacturing of Steel on Aluminium Bronze Bimetallic Parts



DMD process



Steel on Aluminium Bronze Bimetallic Part

Salient Features:

- Good metallurgical bonding
- Controlled heat affected zone
- Controlled dilution
- Good interfacial bonding
- No cracks
- No porosity
- No thermal distortion

Specification:

- Max. build volume:300X 300X 300 mm
- Deposition material : Tool Steel
- Substrate material: Aluminium Bronze

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Tool Steel powders.
- Aluminium bronze substrates.
- Argon and Helium gases

Major Plant Equipment and Machines required :

- Direct Metal Deposition additive manufacturing machine and General purpose manuafacturing facilities like lathe, milling and grindingmachines etc.

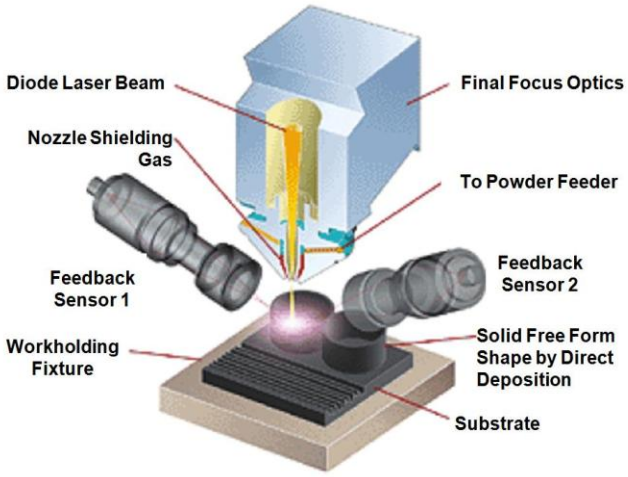
Techno economics :

- Potential exists for additive manufacturing of complex bimetallic parts. High quality bimetallic parts with good metallurgical bonding can be produced.

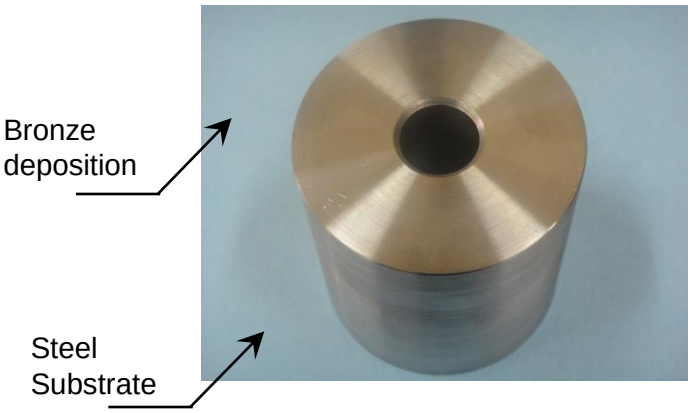
Technology Package:

- Methodology & Process parameters

Additive Manufacturing of Bronze on Steel Bimetallic parts



DMD process



Bronze on Steel Bimetallic Part

Salient Features:

- Good metallurgical bonding
- Controlled heat affected zone
- Controlled dilution
- Good interfacial bonding
- No cracks
- No porosity
- No thermal distortion

Specification:

- Maximum build volume: 300X 300X 300 mm
- Deposition material : Bronze
- Substrate material: Steel

Level of Development :

- TRL 7

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Bronze powders.
- Steel substrates.
- Argon and Helium gases

Major Plant Equipment and Machines required :

- Direct Metal Deposition additive manufacturing machine and General purpose manuafacturing facilities like lathe, milling and grindingmachines etc.

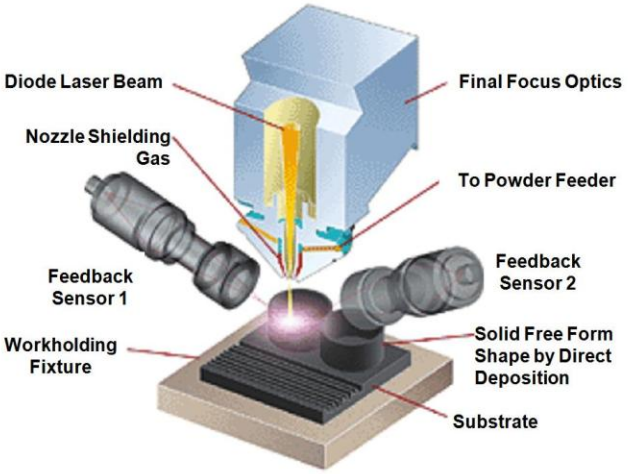
Techno economics :

- Potential exists for additive manufacturing of complex bimetallic parts. High quality bimetallic parts with good metallurgical bonding can be produced.

Technology Package:

- Methodology & Process parameters

Remanufacturing of components through Additive Manufacturing



DMD process

Remanufactured Part

Salient Features:

- Good metallurgical bonding
- No thermal distortion
- Controlled heat affected zone
- Controlled dilution
- Good interfacial bonding
- No cracks
- No porosity

Specification:

- Maximum build volume: 300X 300X 300 mm
- Deposition material : Steel, Inconel
- Substrate material: Any metal

Level of Development :

- TRL 8

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised:

- Steel powders
- Inconel powders
- Argon and Helium gases

Major Plant Equipment and Machines required :

- Direct Metal Deposition additive manufacturing machine and General purpose manuafacturing facilities like lathe, milling and grindingmachines etc.

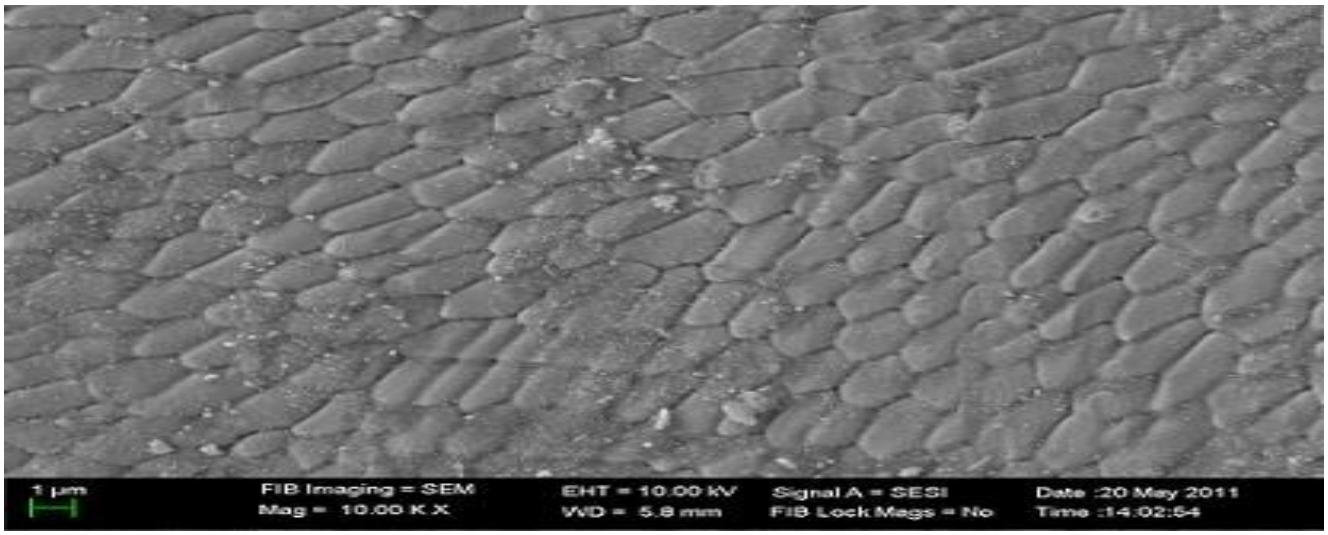
Techno economics :

- Potential exists for Remanufacturing of expensive engineering parts for Aerospace, Automotive, Energy, Tooling etc. High quality remanufactured parts can be Produced saving material, energy, time and cost.

Technology Package:

- Methodology & Process parameters

Steel-Carbon Nano Tube Metal Matrix Composites through Additive Manufacturing



SEM image of Steel-Carbon Nano Tube Composites

Salient Features:

- High strength
- Light weight
- Complex-geometry parts
- Less lead-time

Specification:

- Maximum build volume: 250X 250X 150 mm
- Matrix material : Stainless Steel
- Reinforcement material: Carbon Nanotubes

Level of Development :

- TRL 3

Status of Commercialization:

- Ready for Technology Transfer

Major Raw materials Utilised :

- Steel powders
- Carbon nanotubes
- Substrates

Major Plant Equipment and Machines required :

- Direct Metal Laser Sintering additive manufacturing machine and General purpose manufacturing facilities like lathe, milling and grinding machines etc.

Techno economics :

- Potential exists for manufacturing of high strength and light-weight complex parts for Aerospace, Automotive, Energy etc.

Technology Package:

- Methodology & Process parameters

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