



Touching lives
through
Electrochemistry



State-of-the-art
R&D at
your reach

Technology Capsules

सीएसआईआर-केंद्रीय विद्युतरसायन अनुसंधान संस्थान
CSIR-Central Electrochemical Research Institute

[वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद]
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RECENT SUCCESSFUL TECHNOLOGIES

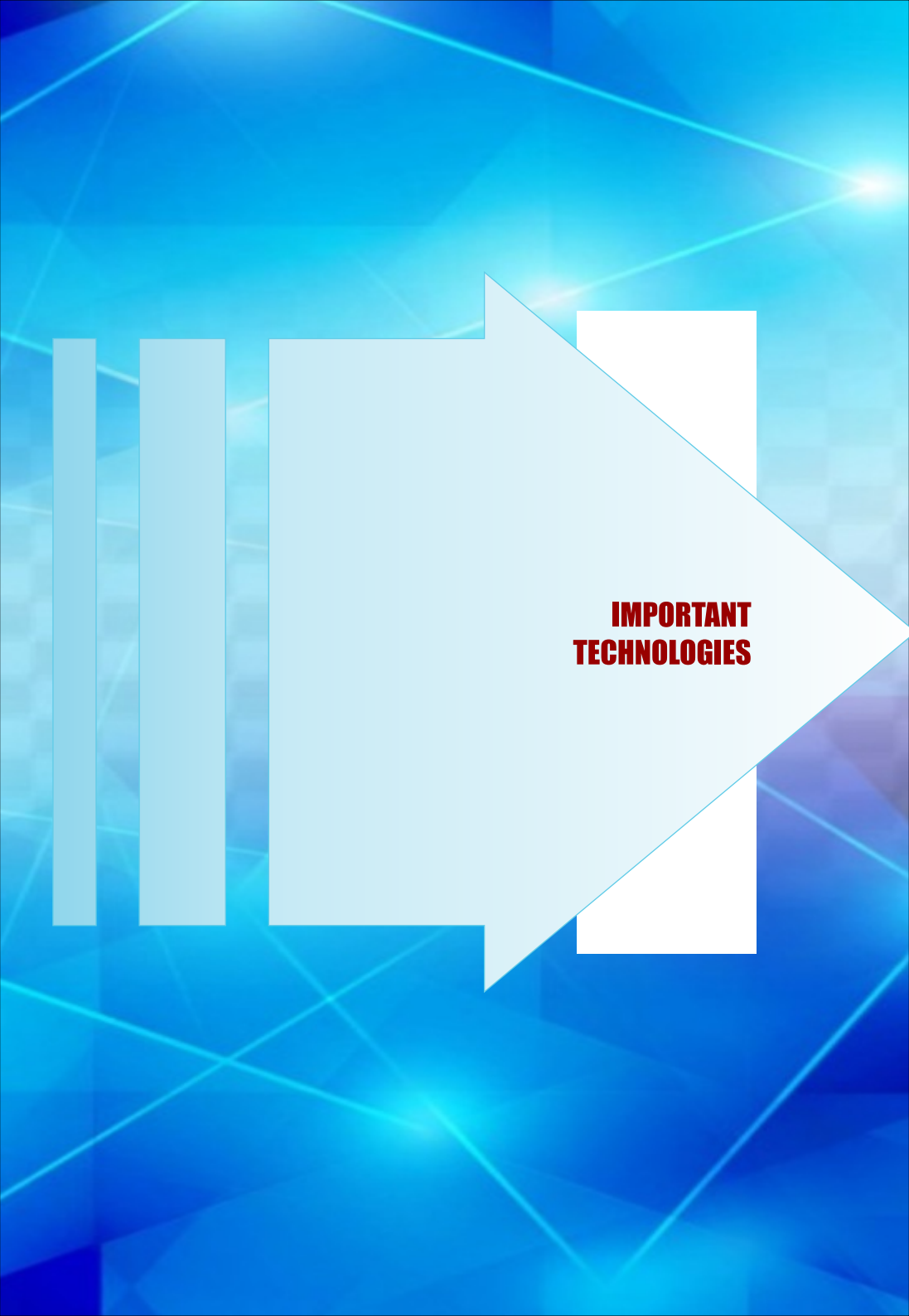
- ◆ Polymer Electrolyte Membrane (PEM) fuel cell
- ◆ Electrochemical defluoridation of drinking water
- ◆ PEM electrolyser
- ◆ Cement-polymer composite coating system for corrosion protection of reinforcing and prestressing steels
- ◆ Anticorrosive treatment for steel reinforcement rods
- ◆ Multicoat protective scheme for concrete structures and bridges
- ◆ Corrosion-resistant inhibitive admixture for portland pozzolana cement
- ◆ High-performance epoxy PAB coating system
- ◆ Corrosion resistant thermal coating for hydroclaves
- ◆ Neutral paint-removing jelly
- ◆ Indigenous Li-ion battery (in collaboration with CGCRI & NPL)
- ◆ Redox-active polymer encapsulated lamellar compound-based anticorrosive coating for reinforcement bars
- ◆ Integrated corrosion monitoring sensor gadget accessible through a mobile App
- ◆ High-temperature ceramic thermal barrier coatings for missile components
- ◆ Non-enzymatic electrochemical method for simultaneous determination of total haemoglobin and glycated haemoglobin
- ◆ Electrochemical synthesis of perfluorobutane sulfonylfluoride
- ◆ Process for the production of tetra methyl ammonium hydroxide from tetra methyl ammonium chloride
- ◆ Triboluminescent coating and smart camera for crack detection in structural components



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**IMPORTANT
TECHNOLOGIES**

IMPORTANT TECHNOLOGIES

PEM Electrolyser

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail

: Indian Patent filled
2760 DEL 2011

Application/Uses

: Weather balloons, Thermal
power plants, Fuel cells

Salient Technical Features for this unit :

- ♦ Raw material is pure water
- ♦ Hydrogen on demand
- ♦ Pressurised Hydrogen
- ♦ Micro processor controlled
- ♦ LED display indicates system status
- ♦ Automatic leak detection
- ♦ Low water and poor quality indication

Status of Commercialization

: Commercialized



1Nm³/h PEM - water electrolyser unit



Electrochemical defluoridation of drinking water

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Defluoridation of drinking water

Salient Technical Features
including Competing Features :

- ◆ Removes fluoride content from 5 ppm to < 1.0 ppm in potable water
- ◆ Principle involves electrochemical dissolution of aluminium alloy followed by coagulation and electro-flotation.
- ◆ Continuous flow process of 20 and 200 L/h capacity

Status of Commercialization : Commercialized



200 l/h Electrochemical defluoridation unit

Development of high temperature ceramic thermal barrier coatings for missile components

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Indian patent filed

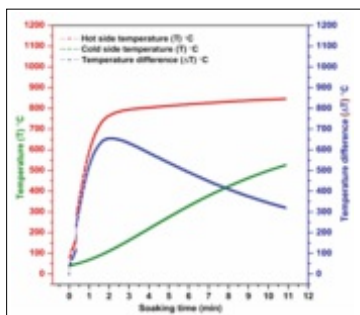
Application/Uses : Thermal protection systems for defence, space and aerospace sectors

Salient Technical Features

including Competing Features :

Thermal barrier coatings developed by electro-plating and plasma spray process to demonstrate temperature difference of 250-500°C

Status of commercialization : Yet to be commercialized



Thermal shock measurement of multi-layered TBCs



Cement polymer composite coating system for corrosion protection of reinforcing and prestressing steels

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Indian Patent No. 481 / Del / 93 dt. 13.05.1993 - An improved formulation for a rapid setting primer useful for corrosion protection of reinforcing and prestressing steels

Indian Patent No. 259 / Del / 92 dt. 25.03.1992 - An improved coating composition for corrosion protection of reinforcing and prestressing steels

Application/Uses

: To protect steel rebar embedded in concrete structures exposed to marine environment

Salient Technical Features

including Competing Features : In-situ process Improves bond strength
Cost effective

Status of Commercialization : Commercialized



Application of CPCC coating in various bridge structures

Amorphous Alloy Coatings by Sputtering for Surgical Tools and Bioimplants

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Patent No: 201611022422

Application/Uses :

To enhance mechanical and corrosion properties; Hemocompatible & Biocompatible; Antimicrobial; low roughness and Non cytotoxic in nature. Coatings for short term implants/ Elimination of secondary surgery

Salient Technical Features

including Competing Features :

- No hazardous is found to be released to the environment.
- Sputtering is a vacuum operated and eco-friendly technique.
- Lower Young's modulus of 50-100 GPa
- Better hemocompatibility
- Non cytotoxic (Graded less than 1 as per ISO 10993-5, 2009)
- Antibacterial and biocompatible

Bio degradable (Elimination of secondary surgery)

Status of Commercialization : Yet to be Commercialized



Degradable amorphous alloy coatings



Glassy metal coated surgical tools





Indigenous Li-ion Battery

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail

: Granted 2 patents in Japan,
China, Europe

Filed 4 patents in USA, Korea
for Cathode, Anode and Separator

Application/Uses

: Solar Lantern, toys, power banks,
XEV's, Solar (grid), medical and
all commercial electronic
equipments

Salient Technical Features

including Competing Features :

- Cathode material delivers a capacity of 175 to 225 mAh/g compared to commercial LiCO_2 .
- Carbon paper eliminating use of copper foil and reducing the cost by 5 %
- Separator superior to celgard materials

Status of Commercialization

: Yet to be commercialized



Solar lantern



LED flood light , Power bank, BMS circuit

Redox active polymer Encapsulated Lamellar {REL}compound based Anticorrosive coating for reinforcement bars

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Indian Patent
No: 0056NF15 dt. xxx

Application/Uses :

To protect steel rebar corrosion embedded in concrete structures exposed to vulnerable environment

Salient Technical Features

including Competing Features :

The Anticorrosive coating system containing REL compound ...

- offers excellent corrosion protection of steel embedded in concrete
- repassivates the exposed steel rebar surface at pin holes and arrests the corrosion of steel rebars at these locations due to its redox property.
- replaces the conventional toxic pigment based coatings.
- resists the permeation of very high concentration of 7% NaCl even under accelerated condition.

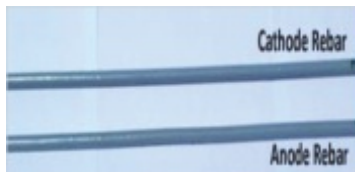
RCC specimens embedded with this newly developed anticorrosive coated rebar withstand more than 1750 hours for initiation of crack even under accelerated test condition

Status of Commercialization

: Ready for commercialization



Corrosion free rebar after time to cracking study



Corrosion free rebar after cathodic disbondment test



Anticorrosive treatment for steel reinforcement rods

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail :

Already patented.

465/CAL/75 {Derusting solution},
109897 {Phosphating jelly },
109784167 {Inhibitor solution}and
112440/67 {Sealing solution}.

Application/Uses:

- Offers higher corrosion resistance due to inhibitors addition
- Service life of concrete structures increased by several folds
- Bond strength in RCC structures is not affected.
- Chemicals used available indigenously

Salient Technical Features

including Competing Features :

Properties of the coating:

Thickness : 0.3 ± 0.1 mm

Hardness : Rockwell superficial 40 HR 15N

Bonding strength : No adverse effect & strength improved.

Behaviour under load : Coating cracks only when steel begins to yield
i.e. 2800 kg/cm².

Corrosion resistance of coated steel ;

Salt spray test : > 2000 hours.

Immersion in synthetic sea water : > 30 days.

Immersion in 10% ammonium sulphate : >15 days.

Exposure at Mandapam : 6 months.

Exposure at Karaikudi : > 26 months

Status of commercialization : Commercialized



Corrosion resistance Thermal coating for Hydroclaves

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

This coating is used to protect the steel structures from corrosive as well as high pressure and temperatures

Salient Technical Features

including Competing Features :

Protective coatings available in the market are not withstanding at high temperature and humidity. The polymer composite of Epoxy – Silicone composite developed by CSIR-CECRI is highly corrosive resistance. Thermally stable pigments are incorporated and exhibited performance as per ASTM standards

Status of Commercialization : Commercialized



*Lid of Hydroclave coated with CECRI developed coating at VSSC,
Thiruvananthapuram, Technology transferred to VSSC, Thiruvananthapuram*



Multicoat protective scheme for concrete structures and bridges

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

Four coat system used for the protection of concrete structures and bridges for long duration ~ 10 years from corrosive marine as well as industrial environments.

Coating can be applied by spray or brush

Salient Technical Features

including Competing Features :

This system consist of epoxy primer, epoxy –MIO undercoat, Epoxy TiO_2 top coat followed by Ali. Polyurethane finish coat

Status of Commercialization : Commercialized



Pamban bridge is coated with this multicoat system



Formulation of Neutral paint removing Jelly

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

.This jelly is useful for removing old paint for painting maintenance in industries

Salient Technical Features

including Competing Features :

Marketly available paint removers are solvent and phenolic based formulations. These formulations are health hazards and polluting the environment.

The new formulation is based on Hydrogen peroxide and removes the epoxy and Urethane based paint easily.

Status of Commercialization : Commercialized



400 μ coating lifted from the steel surface after 2 Hrs



Super Hard Coatings by sputtering of Metallic Nitrides for Decorative / Cutting Tools/ Biomedical Applications

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Patent No. 0359DEL2011

Application/Uses :

Coatings can be used in biomedical implants such as those used in orthopedic, orthodontic and cardiovascular supports. Also used to enhance the life time of cutting tools. Nitride coated needles with enhanced mechanical properties to prolong lifetime of needles. The products can also be used for decorative applications like ornaments, textiles etc.

Salient Technical Features

including Competing Features :

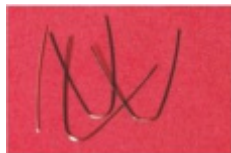
No hazardous is found to be released to the environment as sputtering is a vacuum operation; Eco-friendly technique

Lower friction coefficient of 0.2 for titanium nitride coating and better wear resistance for the multilayer coated sample.

Excellent bonding to the substrate

Substrate temperature can be varied widely from sub zero to 500°C.

Status of Commercialization : Yet to be Commercialized



*TiAlN coated
orthodontic wire*



DLC coated tools



*TiN coated
cookware*



TiN coated Needles





Integrated Corrosion Monitoring Sensor [ICMS] gadget

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail

:

Submitted Patent in India

File No: 0215NF2016

Application/Uses

:

Corrosion Monitoring in concrete Structures ...

- Nuclear Reactor Buildings
- Dams & Tunnels
- Bridges & Viaducts
- High-rise & historical buildings
- Foundations
- Construction sites
- Mining
- Settlement areas

Salient Technical Features

including Competing Features

:

ICMS is a versatile integrated sensor gadget, a basket of sensors to measure potential, corrosion rate, resistivity and temperature simultaneously to alert us on the health of structures/bridges/reactors. Early detection of corrosion through this all terrain compatible embeddable sensor has been made accessible through a custom designed Mobile App for corrosion monitoring in civil infra structures. Keeping this handy and wireless remote control, one can have continuous monitoring of civil structures aided by scientific data from anywhere and everywhere.

- Predictive maintenance utilizes non-destructive testing using sensor technology
- Detects existence of damage in the structures
- Locates damage as and when occurs

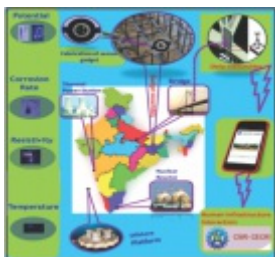


- Identifies type of damage
- Quantifies damage severity
- Includes reliability-centered maintenance
- Alerts and extends clues on Corrective maintenance

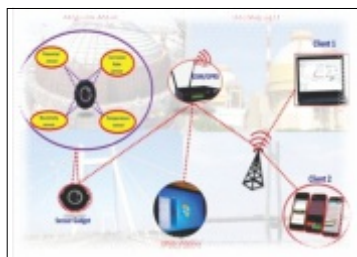
Status of commercialization

:

Yet to be commercialized



CECRI's Second generation sensor in the form of ICMS



Functioning of ICMS as model App

3-Chloromethyl azetidinone ester (Cephalosporin Antibiotic)

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Indian patent
no. 0294.NF.2002/IN

Application/Uses :

Cephalosporins are antibiotics used to treat a wide variety of bacterial infections, such as respiratory tract infections, skin infections and urinary tract infections.

Salient Technical Features

including Competing Features : ***

Status of Commercialization : Yet to be commercialized



3-Chloromethyl azetidinone ester (Cephalosporin Antibiotic)



Electrochemical synthesis of Perfluorobutane sulfonylfluoride

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

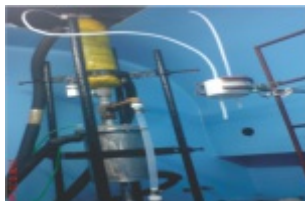
Intermediate to synthesis various fluoro surfactant. It may substitute perfluoro octane sulfonate in various applications. Its alkali salt ($C_4F_9SO_3K$) is one of the best fluoro anion surfactant and the best fire retardant for polycarbonate.

Salient Technical Features

including Competing Features :

- Indigenous single step and simple operation
- Alternate process to chemical fluorination method
- Energy minimal
- Optimal space usage

Status of Commercialization : Commercialized



Electrochemical perfluorination cell set up



Electrochemical Dyeing of cotton fabrics

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

Vat dye is most the popular among the dye classes used for coloration of cotton fabrics, particularly, when high fastness standards are required to light, washing and chlorine bleaching

Salient Technical Features

including Competing Features :

Indigenous single step and simple operation. Alternate process to the chemical dyeing process.

Status of Commercialization : Commercialized



Electrochemical Dyeing of cotton fabrics



Electrochemical conversion of DL-Homocystine to DL-Homocysteine

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Pharmaceutically important Intermediates

Salient Technical Features

including Competing Features : Electro- catalytic process through Paired Electro synthesis Route with 200% Efficiency.

Status of Commercialization : Commercialized



Electrochemical Flow Cell for the conversion of L-Cystine to L-Cysteine



1,4-Naphthoquinone

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Pharmaceutically important Intermediates

Salient Technical Features

including Competing Features :

More economical method than other methods involving inorganic oxidizing agents, because the oxidant can be regenerated and used, has excellent selectivity and avoids disposal of spent reagents.

Status of Commercialization : Yet to be commercialized



Schematic diagram for the conversion of Naphthalene to 1,4-Naphthoquinone



Biodegradable inhibitor for preventing scale and corrosion deposits of steel pipeline in cooling water system and process thereof

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : 1 Patent is filed

Formulation containing cerium –molybdate(Ce-Mo) incorporated in polymer matrix for the corrosion protection of low carbon steel in cooling water and process thereof No:201611011068

Application/Uses :

- i. open circulating cooling system used in power plants
- ii. Cooling towers & pipelines used in chemical industries
- iii. pipeline used in nuclear power plants for cooling purpose

Salient Technical Features

including Competing Features :

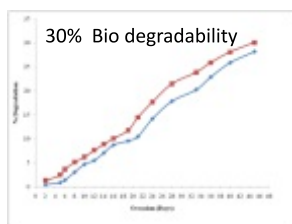
- ♦ Low toxicity to aquatic species;
- ♦ non-toxic to mammals
- ♦ Biodegradable
- ♦ Safe for workers to handle
- ♦ Environmentally safe
- ♦ Non-volatile, non flammable or non- explosives

Status of commercialization : Yet to be commercialized



GREEN INHIBITORS FOR COOLING WATER SYSTEMS

S. No	TEST CONDITION	EFFICIENCY (%)
1	Control(without inhibitor)	-
2	PGA-300 ppm+AM-100 ppm	84
3	PGA-500 ppm+AM-100 ppm	92
4	PGA-500 ppm	73
5	PGA-400 ppm+AM-50 ppm	95
6	Po43- treatment 50 ppm+5th test	83
7	Po43- treatment 100 ppm+5th test	96



CECRI developed GCI showing bio degradability

No.	SYSTEM	EFFICIENCY (%)
1	SCW	-
2	HEDP-100 ppm	71
3	HEDP-200 ppm	100
4	PGA-400 ppm	97

Temperature Tolerance up to 55-600 C : PROVEN



Sputter Etching of brass valves for bonding to rubber

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

Etched surface of brass valves for bonding rubber tubes

Salient Technical Features

including Competing Features :

- The hazardous chemicals used in chemical cleaning cum etching may release hydrogen onto the surface of the metal and causes embrittlement.
- Improper removal of dust constituents from chemical etching takes place leaving a smut on the metal surface. These are avoided by sputtering process as it is a eco-friendly process; in addition a good substitute process for etching.

Status of Commercialization : Yet to be Commercialized



Sputter Etched brass valves

Triboluminescent (TL) paint triggered luminescence signal identifying smart camera for crack detection of structural components

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : 2 Patents are filed

1. Development of triboluminescent paint for detection of cracks and crashes in concrete structures. (Ref.No.201611009895)

2. Device for crack detection on structural element using TL impregnated sensor matrix (Ref.No.201711006778) Indian Patent application No: 201611022422

Application/Uses :

Reliable real-time damage assessment of engineering structure such as building, dams, bridges, aircraft and spacecraft At present no single technique is available to provide reliable results in a cost effective manner.

- Damage of various structures components such as building, bridges, and aircraft.
- Marine and Space application.
- Fiber reinforced concrete structure.
- To detect leakages in tunnels/ pipe lines.
- Fuse system of army warhead.



Indigenously developed TL Camera

Salient Technical Features including Competing Features :

- Real-time failure monitoring of structure
- In-built remote monitoring
- Cost effective
- Eliminate skilled operator

Status of Commercialization : Yet to be commercialized



Simultaneous detection and inhibition of corroding steel structures by imine functionalized silica aerogels and its process thereof.

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Indian Patent application Filed (under process)

Application/Uses :

Facile synthetic approach to prepare imine modified silica nanoparticles by dipping amine modified silica aerogels in acetone. When applied over mild steel plates IMSNP was found to be sensitive (via color change) and inhibitive (prolonged salt spray) for the corroding steel structures.

Salient Technical Features Including Competing Features :

- First synthesis of imine terminated silica nanoparticles, by dipping amine silica nanoparticles in acetone at ambient pressure and temperature. The volume of the gels was retained by supercritical CO₂ drying.
- The Imine terminated silica nanoparticles can coordinate with Transition metal ions to change their body color through Schiff base mechanism.
- The imine silica nanoparticles can be mixed with acrylic primer and coated on steel structures to detect and inhibit the corrosion of steel structures.
- The conventional tedious synthesis of dyes based on Schiff base can be eliminated and replaced through this simple and effective synthetic scheme.
- In addition to its fascinating corrosion sensing properties, imine silica nanoparticles can act as corrosion inhibitor for protecting steel structures.

Status of Commercialization : Commercialized



Pristine mild steel (MS)



IMSNP coated MS



3-kW LT-PEMFC for stationary power application

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Technology to be transferred to Reliance

Application/Uses : 3 kW electric power output for telecom towers

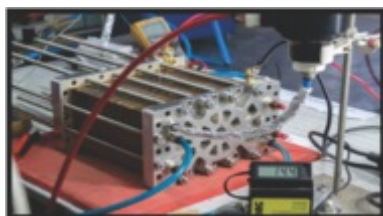
Salient Technical Features

Including Competing Features : Low Catalyst content
Better durability
Reliable power source
No pollutants
Elimination of DG set.

Status of Commercialization : Yet to be commercialized



Testing assembly



Fuel cell stack



Development of Modified Polymer Electrolyte Membranes Fuel Cell (PEMFC) Stacks for Hydrogen Removal

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : 1 kW air cooled PEMFC stack for hydrogen utilization

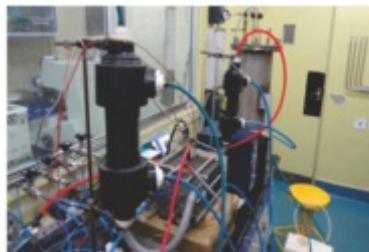
Salient Technical Features Including Competing Features :

- Air cooled stack
- Ambient pressure of operation
- Hydrogen utilization
- Pollution free device
- Reliability and durability

Status of Commercialization : Commercialized



20 cell, 1 kW PEMFC stack H_2 - O_2 ;
1.45 kW; H_2 -air: 1.0 kW



1 kW PEMFC system demonstration
at IGCAR, Kalpakkam



Zinc-Nickel electrodeposition on Stainless steel

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Useful for Aerospace application

Salient Technical Features

Including Competing Features :

- ♦ High corrosion resistance
- ♦ Good throwing and covering power
- ♦ Plating rate is good
- ♦ High cathodic current efficiency
- ♦ Good adhesion
- ♦ Thickness distribution is good

Status of Commercialization : Commercialized

Lead free Electroplating process for Cu-Sn alloy and Ag-Bi bilayer

PR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Used for bearings

Salient Technical Features

Including Competing Features :

- ♦ Good mechanical properties
- ♦ Eliminating hazardous Pb in the alloy composition (Lead free process)
- ♦ Good cathodic current efficiency
- ♦ Good plating rate
- ♦ Simplest process.

Status of Commercialization : Commercialized





Electroplating of Gold

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Used for satellite and other decorative ornaments.

Salient Technical Features

Including Competing Features :

- ♦ Good adhesion
- ♦ Good throwing and covering power
- ♦ High plating rate
- ♦ Good cathodic current efficiency
- ♦ Suitable for functional applications
- ♦ Bright appearance

Status of commercialization : Commercialized



Gold plated momentum wheel for satellite

Electropolishing of AISI 304 stainless steel

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Useful for functional and aesthetic application

Salient Technical Features

Including Competing Features :

- ♦ Simple set up
- ♦ Smooth surface and low roughness
- ♦ Good corrosion resistance
- ♦ Pleasing appearance
- ♦ This technology is useful for many applications where stainless steel components are used.

Status of Commercialization : Commercialized



Electropolished stainless steel piston rods and other components



Copper plating of Stainless steel

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Used in particle accelerator

Salient Technical Features

Including Competing Features :

- ◆ Good adhesion
- ◆ High thickness distribution
- ◆ High throwing power and covering power
- ◆ Ductility is good
- ◆ Current efficiency and plating rate is good
- ◆ Suitable for thicker coatings.

Status of commercialization : Commercialized



Copper plated particle accelerator component

Coloring of Stainless steel

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Useful for home appliances

Salient Technical Features

Including Competing Features :

- ♦ Cost effective
- ♦ Simplest process than the other coloring technology
- ♦ Pleasing appearance
- ♦ Durability and shiny color appearance

Status of commercialization : Commercialized



Colored stainless steel panels and tubes



Brush Electropolishing of 316LN Stainless steel

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

Useful for contamination removal in nuclear pump walls and pipelines.

Salient Technical Features

Including Competing Features:

- ◆ We can use this technology on site, i.e no need to dismantle the contaminated components
- ◆ This technology we can execute using robot. So this approach will avoid the nuclear material exposure on to the environment and human
- ◆ We can achieve ultra smooth surface with very low roughness.
- ◆ Controlled removal of surface contamination without affecting the base substrate
- ◆ This technology provides defect free surfaces without pits and scratches

Status of Commercialization : Commercialized



Barrel Electro polishing of stainless steel needles

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses : Useful for medical applications

Salient Technical Features

Including Competing Features:

- ◆ Uniform polishing
- ◆ More productivity
- ◆ Cost effective
- ◆ Low surface roughness
- ◆ Pleasing appearance
- ◆ It is applicable for other small stainless steel components like bolts, nuts and pins.

Status of commercialization : Commercialized



Electropolished surgical needles



Anodizing of Aluminium

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : ***

Application/Uses :

Used for kitchen utensils , interior decorations and automotive applications

Salient Technical Features

Including Competing Features :

- ◆ Anodized Aluminium can be used for functional applications due to its hard nature.
- ◆ It is useful for making kitchen utensils due to its high thermal conductivity example Aluminium Cookers.
- ◆ Useful for interior decorations
- ◆ It is useful in automobile industries to reduce total vehicle weight

Status of commercialization : Commercialized



Hand anodized aluminium components



Corrosion Resistant inhibitive admixture for Portland Pozzolana Cement

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Patent No: 1421 / Del / 99

Application/Uses :

- ♦ Process involves adding inhibitors in the form of powders during manufacturing of cement or while making concrete at site
- ♦ More corrosion resistant than normal cement due to the inhibitive nature of the additives
- ♦ Used for constructions in aggressive marine environments

Salient Technical Features

including Competing Features :

Table 1 Physical Properties

Test	PPC	Inhibitor admixed PPC
Compressive Strength {N/mm ² }	16.00	16.50
Mortar specimens (3 days)	17.75	19.83
Mortar specimens (7 days)	387	387
Concrete specimens (28 days)		
Tensile Strength {N/mm ² }	1.240	1.260
Consistency [for 33 mm penetration]	0.328	0.290
Initial setting time (minutes)	149	135
Final setting time (minutes)	345	330

Status of Commercialization : Commercialized

Table 2 Corrosion resistant properties of cements

Performance Studies	Added chloride (ppm)	PPC	Inhibitor admixed
Weight loss {Corrosion Rate - mmpy }	10000	0.0191	0.0029
Electrochemical Impedance (Rct value) {K ohms cm ² }	10000	3.591	49.377
Linear Polarization resistance (Rp value) {K ohms cm ² }	10000	6.220	31.554
Anodic Polarization Potential (mV) Initial	1000	0.750 0.250	1.100 1.000
Peak potential Current {micro ampere}	10000	110	0.325



Corrosion free concrete structure

Metal Oxide Impregnated Fabrics for Surgical Mesh

IPR Status

Patent/Copyright/Trademark secured in

Indian/Abroad IPR Detail : Patent No. 0359DEL2011

Application/Uses :

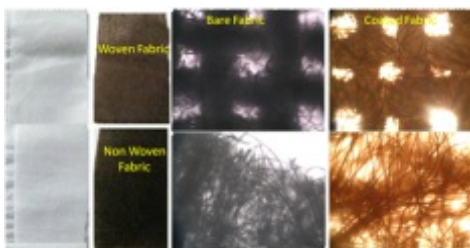
- Fabrics for wound healing pads/ surgical mesh
- Plasma treatment enhanced the coating with metal oxide in fabrics
- Fabric obviously suppressed platelet and red blood cell adhesion

Salient Technical Features

including Competing Features :

- ◆ Non toxic in nature
- ◆ Antibacterial efficiency may be controlled by type of metal oxide and its application
- ◆ The antibacterial property is regenerable
- ◆ Fabric has high antioxidant activity
- ◆ The antibacterial fabrics attained excellent washing durability

Status of Commercialization : Yet to be Commercialized



*Metal Oxide coated Fabrics and
Microscopic Images*



*KrF based Pulsed Laser Deposition
facility at CECRI*