

International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)

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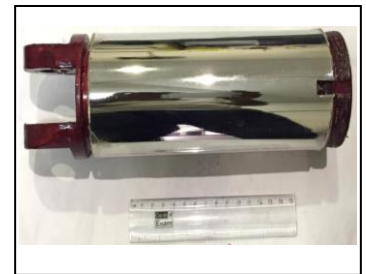
Pulsed Electrodeposition Technology

Overview

Pulsed Electrodeposition is a unique non-line-of-sight electrolytic deposition technique for obtaining wear and corrosion resistant nanocrystalline coatings using modulated currents. The process utilizes non hazardous electrolyte and pulsed current to achieve desired microstructure and mechanical properties in hardness gradient nanocrystalline Nickel, Sacrificial Zn, Nanocrystalline alloys of Ni-P, Ni-W, Ni-Mo, Fe-W coatings. The technology is explored for grain boundary engineering resulting in control over grain size from 200 nm to 3 nm. Recently a new method is invented to deposit nanocomposite coatings for hard chrome replacement with control over inert particle content in coating depending upon application requirement. The new nanocomposite demonstrated excellent wear and corrosion resistance in comparison with hard chrome and commercial NIKASIL coatings. The process is economical and effortlessly scalable to existing electroplating industry with low initial capital investment.

Key Features

- Non line of site process, economical and ecofriendly
- Porosity free finished product, higher production rates
- Control over microstructure, mechanical properties, particle content in composite coating
- Higher current efficiency and deposition rates compared to traditional hard chrome process
- Easy technology transfer from research lab to existing infrastructure



Nanocrystalline coating on Helicopter Hinge Pin (Indian Air Force)

Potential Applications

- Corrosion resistance and decorative coatings: automobiles include car, truck trim, motorcycle, kitchen and bathroom appliances
- Wear resistance: hydraulic actuators, railway engine shafts, aircraft landing gears, shaft journals, farm machinery, earth movers, snow plows, road repair equipment, mining equipment, automobile engine valves
- Industrial tools such as rolls for Al and steel manufacturing, stamping tools and dies, molds for plastic manufacturing utilized chrome plating for increasing its (tool) life



Nanocrystalline alloy coating on car engine valve

Intellectual Property Development Indices (IPDI)

- Performance and stability are validated at laboratory and industry scale
- Scale-up version is also available up to 500 cm² for industrial component

Status	1	2	3	4	5	6	7	8	9	10
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Major Patents / Publications

1. An improved method for preparing nickel electrodeposit having predetermined hardness gradient (Indian Patent: IN200901455-11)
2. A method and an apparatus for preparing nickel tungsten based nanocomposite coating deposition (Indian Patent: 201611001190)
3. Nitin P. Wasekar et al., Materials and Design, 112 (2016) pp. 140-150, Applied Surface Science, 364 (2016), pp. 264-272, Surface and Coatings Technology, 291 (2016) pp. 130-140, Materials Characterization, 116 (2016) pp. 1-7, Wear 342 (2015) pp. 340-348.

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