

New technique of corrosion-resistant nickel alloy coatings

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In news– A new method of deposition of Nickel alloy coatings on high-performance materials in engineering applications can replace environmentally toxic chrome coatings.

About Nickel alloy coatings-

- **Scientists at the Centre for Engineered Coatings at International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI)**, an autonomous Research and Development Centre of the Department of Science and Technology (DST), Govt. of India, has developed a **lab-scale process to deposit novel nanostructured Nickel alloy coatings**.
- The process **uses pulsed current electroplating**, which is environmentally benign with high production capacity.
- In contrast to conventional, direct current used for chrome plating, the research at **ARCI have used electric current in the form of pulses** of duration of a few milliseconds for electroplating purpose.
- **The process consists of an environmentally-friendly electrolyte consisting of nickel and tungsten ions** that is the source of strengthening elemental tungsten (W) and nickel (Ni).
- The pulsed current is applied between the components to be coated, acting as cathode and non-consumable anode.
- The pulsed current effect was used for nano-crystalline coatings wherein high instantaneous current density for very small duration resulted in high rate of nucleation.
- Unlike in conventional direct current plating, the

coatings were virtually porosity free, crack free with minimal hydrogen uptake.

- The use of pulsed current resulted in the nano-crystallization of nickel tungsten alloy coatings with high hardness and wear resistance. The coatings were extremely corrosion resistance and could withstand up to 700 hrs of salt spray.
- The coatings developed at ARCI can withstand temperatures up to 500°C without thermal softening and can improve the life of die components by at least two times than conventional chrome plating.
- They were successfully applied to die-casting components used in plastic bottling industry, wherein the temperatures at the die interface can be over 280°C.
- With numerous applications in automotive, defense, and aerospace for these coatings, the process know-how is ready for transfer as a replacement for conventional chrome plating.

What is chrome coating?

- Chromium coating is a technique that consists of electroplating a thin layer of the chemical element onto metal, to provide protection against wear and corrosion.
- This popular procedure utilises a chromium substance to cover different metal surfaces and is used for a wide range of creative and industrial functions.
- These include hydraulic cylinders and pistons, automotive and mechanical parts, press punches and tooling, mining and agriculture appliances, shafts and rotors, textiles and printing tools, alongside moulds and screws.
- They have been used in plastic bottling industry to improve the service life of die-casting components.
- However, chrome plating is a toxic process, and the stringent standard permissible exposure limit (PEL) for

toxic hexavalent chromium and all its compounds has to be complied in all chrome plating industrial workplaces.