



Environmental-Friendly Decorative Chrome Color and Method of Making the Same

TECHNOLOGY NUMBER: 2023-162



Technology ID

2023-162

Category

Hardware
Engineering & Physical Sciences
Semiconductors, MEMS, and
Electronics

Inventor

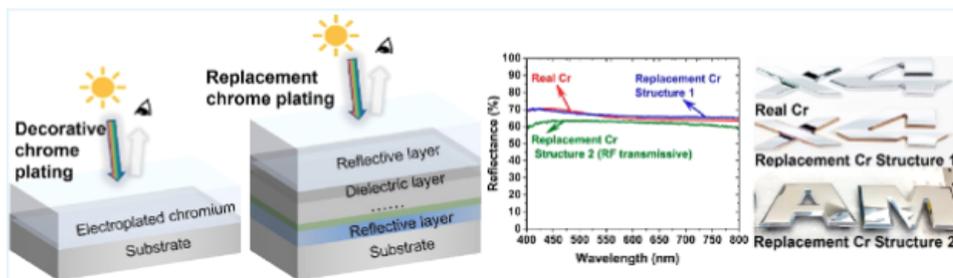
L Jay Guo

Further information

Joohee Kim
jooheek@umich.edu

Innovation Partnerships Tech
Marketing Team

IPInventions@umich.edu



OVERVIEW

Eco-friendly, chrome-mimicking thin film coatings designed by reinforcement learning algorithms.

- Eliminates hazardous chromium plating and offers tuneable, multi-functional, non-toxic decorative finishes.
- Automotive trim, appliances, consumer electronics, RF-transparent sensors, architectural fixtures.

BACKGROUND

Decorative chrome plating is a widely used technique for producing shiny, metallic finishes on automotive, appliance, and plumbing components. Historically, this has involved electroplating with hexavalent chromium, a highly toxic and carcinogenic chemical. Although trivalent chromium methods and non-electrolytic alternatives such as high-velocity oxygen fuel spraying

View online



and laser material deposition have been explored, these typically still use chromium or environmentally harmful compounds and often do not achieve identical aesthetics. Traditional multilayer thin film design—offering a potential alternative—has been limited by the complexity of simultaneously optimizing both material selection and layer thickness, which becomes computationally intensive as the number of layers increases. There is a critical need for a safe, sustainable, and cost-effective alternative to conventional chrome plating that maintains its desirable appearance and is amenable to large-scale manufacturing, without the health and environmental burdens.

INNOVATION

Researchers at the University of Michigan, by using a deep reinforcement learning-based methodology, have developed a multilayer thin film coating that visually mimic chromium plating without using any chromium. The algorithm efficiently explores vast combinatorial possibilities of benign metals, semiconductors, and oxides, autonomously selecting materials and thicknesses to replicate chrome's unique reflective appearance. Two experimental structures—one metal-based, one fully dielectric for radio-frequency transparency—demonstrate that the reflectance spectra and resulting appearance closely match those of standard chrome. The process is adaptable, enabling variation in hue and functionality, and can be applied to various substrates, including glass and plastic. These coatings are robust to viewing angle and substrate, offer customizability for emerging uses such as automotive radar-compatible emblems, and enable safer, greener manufacturing across industries formerly reliant on toxic chrome plating.

ADDITIONAL INFORMATION

REFERENCES:

["Environmentally Sustainable and Multifunctional Chrome-like Coatings Having No Chromium Designed with Reinforcement Learning"](#)

INTELLECTUAL PROPERTY:

Patent application pending.

KEYWORDS:

Structural Color, Chrome Replacement, RF Transparency, Non-toxic Coating, Automotive, Appliances