

Swedish method replaces toxic chromic acid – ”David vs. Goliath”

2021-03-03

[Tommy Harnesk](#)

The Swedish company Cuptronic enables metal plating without the use of the environmentally hazardous and banned chromic acid. However, the toxic substance is still being used within the EU due to an exemption six years ago regarding its use.



Photo 1. Spray gun mounted on robotic arm spraying CBM chemicals for uniform application.

Photo: Niclas Thegerström

Björn Atthoff, CTO at Cuptronic Technology, emphasises that they did not develop their method with the intention of replacing chromic acid.

– We've developed the process because it's an excellent technology for metallising plastics. The fact that it enables chrom free treatment is just a bonus, he says.

Ironically, it's chromium that hinders Cuptronic's chromium-free method, the company's CEO Peter Sjöbeck adds.

– If the EU had not given exemptions for the use of chrom(VI), we would probably have been active on the market a long time ago, he says.

Metal plated plastic parts are found in, for example, vehicles, electronic products, plumbing components. Metallisation of plastic is also common for decorative purposes: on door handles, perfume bottles, gift packaging etc.

Within the EU, it is estimated that approximately 1,600 factories involved with metal plating processes.

Traditionally, the surface of the plastic is etched with chromic acid, which contains hexavalent chromium. The etching step results in a surface structure that the metal coating can bond to. In 2006, the use of hexavalent chromium was banned in the EU, with 2017 as the "sunset date". Thereafter, only companies that have been granted an exemption may use the substance.

Cuptronic's patented, chromium-free technology is called CBM (Covalent Bonded Metallisation). Here, the plastic component is coated with a chemical solution which is then illuminated with UV light.

– A reaction starts where the CBM chemistry reacts to the polymer surface, creating a molecular surface structure that is tailored to bond with the subsequent metal plating, Björn Atthoff explains.

In addition to being non-toxic, the CBM method has many practical benefits. Coating and light treatment require relatively simple machines, which can reduce the cost for altering the production lines. CBM is applied as the first surface treatment step, so the following bulk of the existing metallisation process line can remain intact.

(TRANSLATED)



Photo 2. The company's first fully automated CBM line (for 3-D applications).
The goal is to install it to a major Spanish subcontractor to the automotive industry.
Photo: Niclas Thegerström

The technology will also enable the possibility to metallise plastics that are difficult to coat with processes based on chromic acid, thereby increasing the number of plastic materials and applications that can be used.

– For example, polypropylene, the most common construction plastic, is difficult to metallise with traditional methods. CBM results in better bonding, says Björn Atthoff.

The CBM method has been developed over the course of approximately a decade, with partial funding from Vinnova and the EU. Cuptronic now considers itself to have arrived at a sustainable solution ready for industrialisation. Cuptronic has an ongoing collaboration with a Spanish Tier 1 supplier to Daimler, Seat, Ford and other car manufacturers. Peter Sjöbeck says that the supplier's name is not possible to make public, yet adds that "they make 250,000 pieces per day".

– The goal is for them to acquire the first robot line that produces vehicle components with our method, says Peter Sjöbeck.

Cuptronic is currently participating in an evaluation project by FGK, the German industry association for plating and electroplating companies, where different methods are tested and compared with each other.

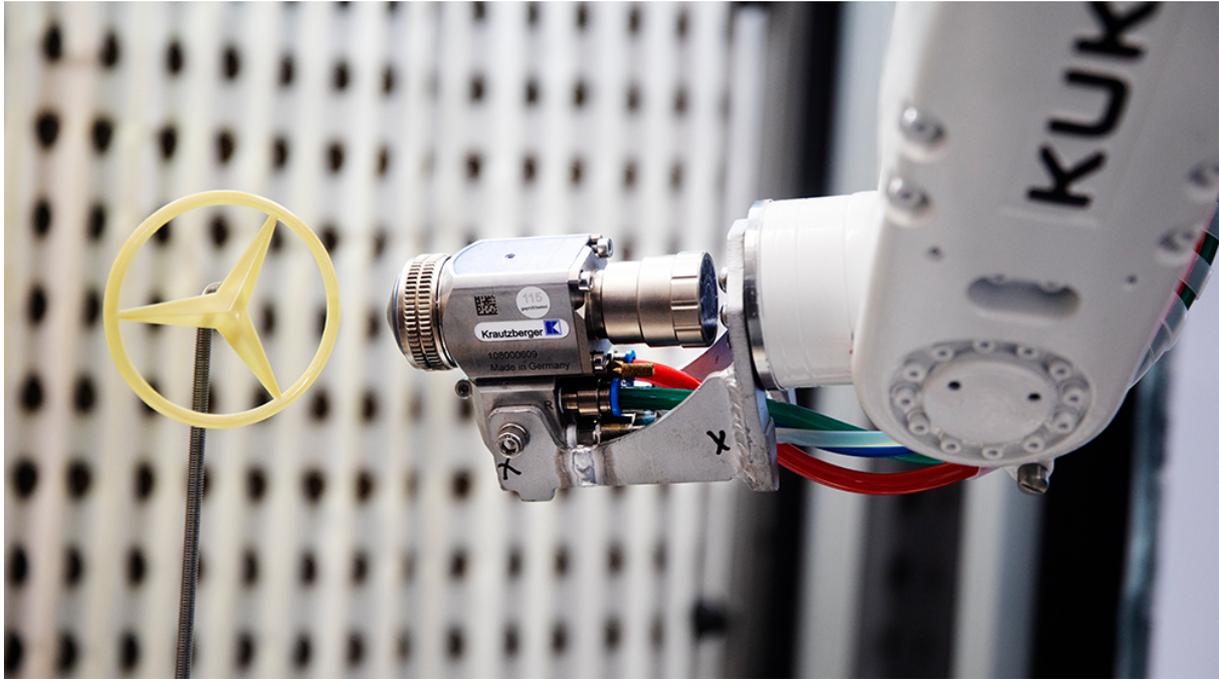


Photo 3. Spray gun, applying CBM chemicals, mounted on a robotic arm.
Photo: Niclas Thegerström

– There are other chromium-free technologies for metallising plastic, but no other method exists that can carry it out on as versatile as CBM. We don't think that we can conquer the entire market, but we consider ourselves to have the potential to take a major part of it. This in turn would help other chromium-free methods find their niche markets, says Peter Sjöbeck.

However, at the EU level, Cuptronic's ambitions were halted: in 2015, two years before the chromium ban was to come into force, a so-called upstream application for a twelve-year exemption from the ban was submitted. The application came from CTAC, a consortium of European plating industries.

– Almost everyone who carries out some form of plating in the EU is covered by these applications, says Jan Ahlskog, who works at the public affairs agency Fipra in Brussels and is Cuptronic's advisor on EU issues.

Exemption until 2024

Last year, CTAC was granted permission to continue using hexavalent chromium for chromed metal components until 2024.

– There are companies that make various machine parts, vehicle components and other objects where we understand the difficulty to achieve sufficient quality with alternative methods. In those cases it may be justified to allow an extension to explore alternatives, says Anne-Marie Vass, investigator at the Swedish Chemicals Agency.

But the upstream application for a twelve-year exemption also applies to the area of use called “functional chrome plating with decorative character”. Sweden has, through the Swedish Chemicals Agency, voted against the continued use of hexavalent chromium in this area.

– We are more sceptical about chrome plating for decorative purposes. We believe that it should be possible to find alternative methods or other solutions to use, says Anne-Marie Vass.



Photo 4. When it comes to plating for decorative purposes, the position of the Swedish Chemicals Agency and Sweden is that alternatives free of chromic acid should be possible to use. This is according to Anne-Marie Vass at the Swedish Chemicals Agency.

Photo: Liselotte van der Meijs

After six years, the European Commission has still not made a decision regarding the matter.

– It just drags on and on. And while waiting for a decision, the companies involved in the upstream application can continue to use hexavalent chromium, says Jan Ahlskog.

He describes the whole thing as a design flaw in the EU's chemicals regulation called REACH.

– The purpose of exemption requirements is to phase out dangerous substances, but it has resulted in the opposite reaction. Since it's possible to continue using prohibited substances while the applications are being processed, the applicant companies have an interest in the process lasting as long as possible, says Jan Ahlskog.

Both Cuptronic and other affected companies have been allowed to submit comments to the European Chemicals Agency ECHA, which is processing the applications. But Jan Ahlskog believes that those who offer alternative methods often find it difficult to follow the process closely enough in order to ensure that decision-makers have a sufficient understanding of their technology.

– It's a second design flaw: you end up with a distorted process with a built-in contraposition between companies like Cuptronic and their potential customers. Since it's in the interest of plating companies to enjoy the exemption period as long as possible, it often means that they ignore or devalue alternative technologies. This is a David vs. Goliath story, says Jan Ahlskog.



Photo 5. Cuptronic's EU advisor Jan Ahlskog. Photo: Fipra

(TRANSLATED)

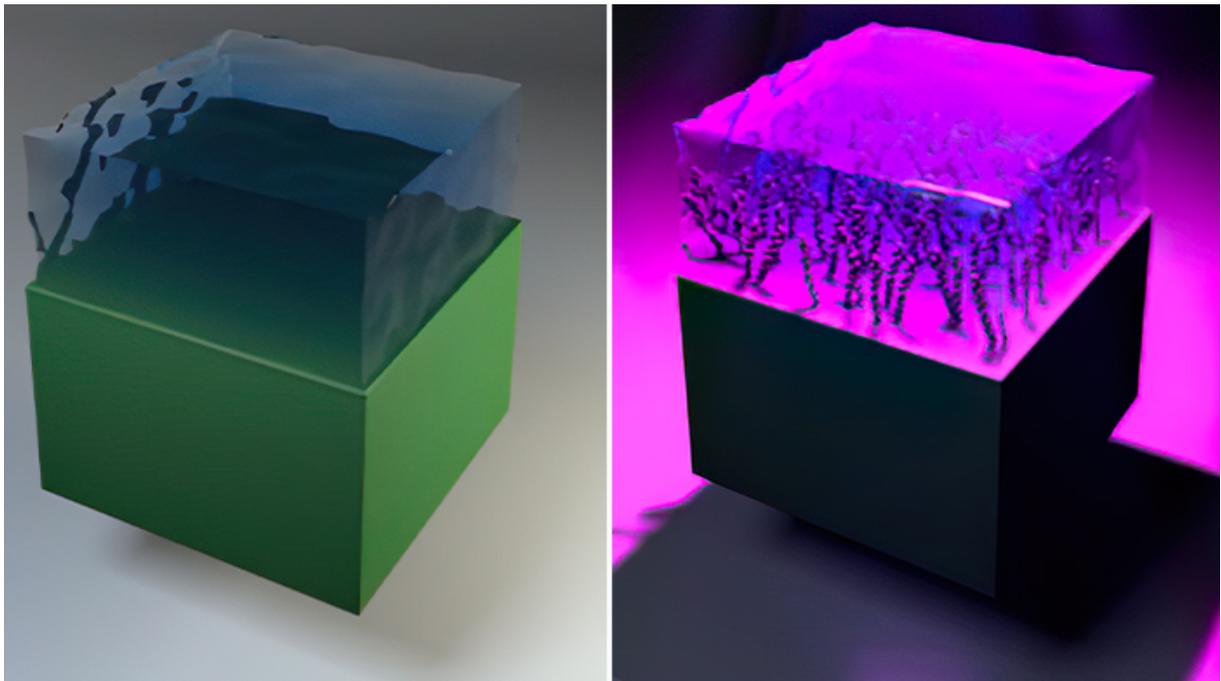


Photo 6. Cuptronic's process called Covalent Bonded Metallisation. Step 1: The plastic component is coated with CBM chemicals. Step 2: The component is illuminated with UV light. The CBM chemistry alter the polymers on the surface. Photo: Cuptronic

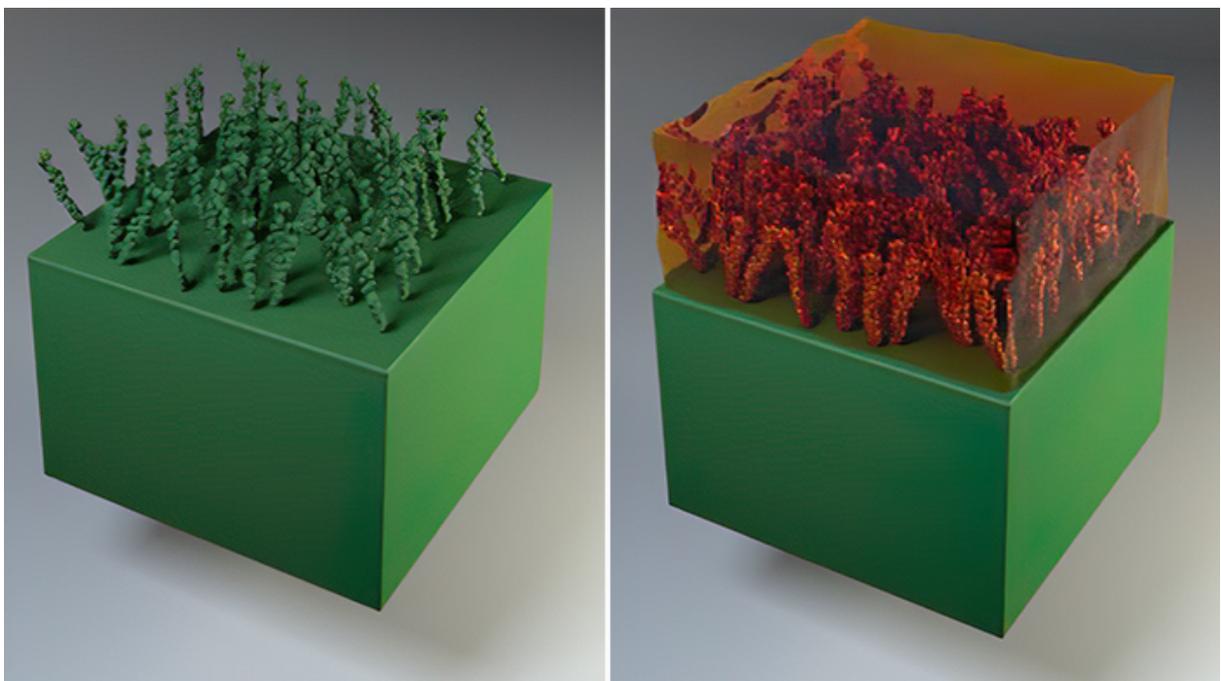


Photo 7. Step 3: The activated surface structure is "tailored" so that the metal plating bonds in place. Step 4: The surface is metallised in a conventional way. Photo: Cuptronic

One might ask here as to why the industry wouldn't choose to ignore the chromium exemptions and switch to the CBM method anyway, if it's non-toxic and has the many practical advantages that Cuptronic says it has?

– The plating companies and their customers want to keep all their alternatives open in order to keep prices down. The logistics chains are also complex and it takes time and money to replace existing suppliers with new ones, says Jan Ahlskog.

Cuptronic, whose business concept is to license its chromium-free method to industrial platers, naturally has its own interest in enforcing the chromium ban. Hexavalent chromium was indeed banned for good reasons: it causes cancer, mutations and severe irritations to the airways and skin. The substance is also harmful to the environment and is suspected of causing reproductive disorders.

The European Commission's decision about the exemption issue will be decisive for Cuptronic's negotiations with three potential customers in the USA, Germany and China.

– I'm not at liberty to reveal their names, but it involves large industry players who manufacture products for the European market. But they do not want to act until they know what happens with the exemption decision. If it ends up being twelve more years, they'll no longer be interested in us, says Peter Sjöbeck.

However, he points out that the issue is not decisive for Cuptronic's future.

– Our Spanish partner will probably acquire a CBM line regardless. If they start delivering 50,000 pieces per day which are plated with our method, then heating, ventilation and sanitation companies, as well as others, will be interested. What happens with the exemptions is not something that will make or break us, but the best thing for the environment and people's health would be that the use of chromic acid disappears as soon as possible, says Peter Sjöbeck.

This is hexavalent chromium

Hexavalent chromium, or Cr (VI), is classified by the European Chemicals Agency ECHA as Substance of Very High Concern (SVHC). SVHC substances include mainly carcinogenic, mutagenic or toxic-to-reproduction substances, as well as substances with long-lasting and bio-accumulative properties.

In order to be allowed to use SVHC substances, a special permit is required. Requiring permits has the long-term goal of phasing out these substances as soon it's possible.

The hazardousness of Cr (VI) is highlighted in the movie Erin Brockovich (2000), with Julia Roberts in the lead role. The film is based on the true story of how the energy company PG&E was forced to pay 333 million USD, the largest private damages awarded in US history, after contaminating drinking water sources in California with hexavalent chromium.

Cuptronic Technology's roots stem from research at The Royal Institute of Technology in Stockholm, Sweden

Cuptronic is an innovation company with roots stemming from the Department of Polymer Technology at The Royal Institute of Technology in Stockholm, Sweden. The company has gone from innovation to laboratory scale and will now begin the industrialisation phase with its patented Covalent Bonded Metallisation process (CBM).

The business model is licensing of its own method, as well as sales of CBM chemicals.

CBM places polymeric structures directly on the surface to be metallised. This is done by spraying on a chemical solution with monomers (molecular building blocks), which are then activated with UV light. This causes the monomers to bond together to polymers (molecular chains), thus forming a structure which is suitable for conventional metallisation.

With the CBM method, additive patterns can also be made by only applying the chemicals in selected places. Then the entire surface is illuminated, after which the metallisation only bonds in place to where the chemicals have been applied.

TOMMY HARNESK