TCCT - Trivalent Chromium Coating Technology

By Tata Steel Europe | Category: Implemented Innovations

Tata Steel has developed a new Tin-Free Steel (TFS) product based on the use of patented Trivalent Chromium Coating Technology (TCCT), to replace ECCS (Electrolytic Chromium Coated Steel). In contrast to ECCS, the new TCCT product is completely European REACH legislation compliant, offering customers a sustainable supply alternative. TCCT is used by customers for lacquered can manufacturing. In addition, Tata Steel is supplying TCCT based Protact products, further enhancing the sustainability profile of the polymer coated packaging steels. The strong IP position enables licensing to 3rd parties to create a new market standard, with Thyssenkrupp Packaging Steel being the first licensee.

The Context

The use of hexavalent Chromium is about to get banned in Europe through the REACH legislation (in order to protect factory personnel from accidental exposure to carcinogenic hexavalent Chromium). It was thought to be impossible to replace hexavalent Chromium chemistry by trivalent Chromium chemistry to produce Tin-Free Steel type products, like ECCS (Electrolytic Chromium Coated Steel). However, the R&D team decided to explore this route further, as there are very few alternative options to design a product without the use of Chromium that can perform as well as ECCS. The team succeeded in finding solutions to adapt the trivalent Chromium chemistry to create a good performing ECCS replacement product.

The Innovation

The challenge was replacing hazardous / carcinogenic hexavalent Chromium solutions to produce Chromium / Chromium oxide coatings, by using non-hazardous trivalent Chromium chemistry. The team succeeded in developing a Chromium / Chromium oxide coated packaging steel product with equivalent properties and in-use performance compared to the existing ECCS product (which is made by using hexavalent Chromium). The idea originated from testing known trivalent Chromium chemistries to try to make an ECCS equivalent product. At the time this was considered not possible, and competitors in the steel industry also attempted this, and concluded it wasn't possible. However, through adapting the existing trivalent Chromium based electrolyte chemistry, the company was able to deposit a Chromium metal/Chromium oxide containing coating in a single process step. The initial versions of the electrolyte and product showed significant promise, and work continued to try to optimise the coating composition. This had led to an optimised electrolyte composition through which it is possible to obtain a coating with the optimal Chromium metal and Chromium oxide composition, which has been shown to perform at least as well as ECCS. It was ensured after a series of process development work that the material can be produced at high line speeds (200-300 m/min) in a revamped electroplating line in the Packaging IJmuiden Works.

Impact of the Innovation

sales impact

developed a new alternative for ECCS

Overcoming Challenges

Challenge #1

Extensive test programs were executed to explore the process conditions required to manufacture the new product at high line speeds. In the third and last stage, the final scale-up to a full manufacturing line was achieved, with a TCCT manufacturing unit being designed and embedded into an existing electroplating line (ETL-14) at the IJmuiden Packaging Works.

Challenge #2

Due to the various uses of TCCT (i.e. lacquered cans, Protact), the commercialisation of the new product is quite a complex process, especially if run in parallel with the implementation of the technology on manufacturing scale, requiring close team work between commercial, customer support, technical, manufacturing functions and R&D.