

Graphene Coatings for Heat Treated Steel

By Tata Steel Europe | Category: Dare to Try

Tata steel is a key supplier of differentiated product such as automotive ultra-high strength steels (HQ1500). This material is widely used for automotive hot stamping market which is estimated to be around 15 million parts produced per year in Europe alone. Usually the material undergoes heat treatments up to 900°C to achieve final mechanical properties. Subsequently, graphene coatings were tested on uncoated HQ1500 and zinc coated substrates. Graphene coating offers unique protection to avoid oxidation and decarburization issues.



The Context

Ultra-high strength steel has to undergo heat treatments up to 900°C to achieve final mechanical properties. However, high temperature oxidation and decarburization are key technical challenges. To overcome this issue, competitors supply aluminum silicon coated substrates which essentially dominates the hot stamping market. Hence an alternative offering was needed to gain the market for Tata steel.



The Innovation

Graphene material offers unique properties such as protective barrier, electrical and thermal conductivity and lubrication properties making it a suitable choice for this application. To keep the cost of coatings low and aligned to conventional coating technologies available at steel works (e.g. roller coatings), Graphene based paints were used. Paints of this type provided the flexibility to tune graphene loading in the paint formulation. In this case max of 5 wt% loading in polymer composite coatings was able to deliver the benefits. Further optimization with multi-layer configuration provides effective protective coatings required for this application.



Overcoming Challenges

Challenge #1

Lack of availability of raw materials, i.e. graphene, with consistent quality and supply. This further required in-house graphene production resulting in development of a patented technology.

Challenge #2

Detailed analytical investigations had to be conducted to confirm appropriate quality of the material followed by development of stable and homogenous graphene-based paint dispersions of particles in coating formulations.

The overall efforts to overcome the above challenges, led the company to achieve valuable IP generation for Tata Steel Europe, and were subsequently useful to translate this knowledge in various other graphene related projects.

Potential
Impact of the
Innovation

revenue impact

£10 mn