# DEVELOPMENT OF SURFACE-EGNIEERED CERIUM OXIDE NANOPARTICLES FOR THE CORROSION PROTECTION OF STEEL

**Anwar Ahniyaz**
**YKI, Institute for Surface Chemistry**
**anwar.ahniyaz@yki.se**

## Introduction

Steel is an excellent material with high strength and outstanding mechanical properties and it has been used for centuries. Exposing bare steel surfaces to a corrosive environment will lead to corrosion of the steel surfaces and thus pose a potential danger to the whole steel structure, reducing its service life. The cost of corrosion is 3-4 % of GDP worldwide and is therefore a very important issue for all modern societies. Many compounds that are used for corrosion protection of steel today are hazardous to the environment and to human health. For example, hexavalent chromium has been used in inhibitive pigments but these pigments are being phased out due to environmental and health concerns. Thus, there is an urgent need to replace current paint systems with new effective systems that are more environmental friendly and not hazardous to human health. Thus, development of new environmentally friendly, anticorrosion coatings with extended durability for steel protection is a global challenge in coating and steel industries.

In this EU funded project, STEELCOAT[1], both high solid solvent-borne and water-borne coatings will be developed and the corrosion protection in these novel coatings will be achieved by combining environmentally friendly nanoparticles and conductive polymer, together with novel compatible binder polymers. One of the main challenges in formulation of nanoparticles into the coating is the stabilization of inorganic nanoparticles in the paints. How to overcome these challenges by using advanced nanoparticle surface-engineering technique will be presented. Examples will be given on different surface modification methods to improve the dispersibility of nanoparticles in solvents such as water, ethanol isopropanol and many other non-polar organic solvents.

## Materials and Methods

A colloidal method was used to create the metal oxide nanoparticles and surface of these nanoparticles were modified to disperse them in both solvent borne and water borne binders. The surface of nanoparticles were engineered to make them stable in the paint formulation so that nanoparticle formulated anti-corrosion paints is stable and can be stored for a long time and applied on steels with any traditional application methods.

## Results and Discussion

As shown in figure 1 that high solid content (10-30 wt %) stable dispersion of ceria nanoparticles in both water (at pH=8,5) and butyl acetate have been developed by YKI. They are not only stable for more than a year but also compatible with most of the commercially available solvent borne and water borne paints.

Figure 1 Photo of 10wt% cerium oxide nanoparticles in water at pH=8,5 (left) and in butyl acetate (right)

## Acknowledgments

This work was supported by the Steelcoat Project ( NMP-2010.1.2-2 Substitution of materials or components utilizing Green Nanotechnology. Project Number: 263262) funded by FP7 program of European Commission.

## References:

1.http://steelcoatproject.com