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Corrosion-Resistant Nano-Coating for Metals

The problem of corrosion of metals has always been in focus of scientific attention. The recent developments in the sphere are investigated in this paper.

Corrosion, in this particular case, is the gradual destruction of metal by chemical reaction with its environment. In the most common use of the word, this means electrochemical oxidation of metals in reaction with an oxidant such as oxygen. Understanding necessity of further research scientists at the U.S. Department of Energy's Brookhaven National Laboratory have developed a method for coating metal surfaces with an ultrathin film containing nanoparticles – particles measuring billionths of a meter – which renders the metal resistant to corrosion and eliminates the use of toxic chromium for this purpose.

To keep pace with the rapid changing need in mechanical engineering, numerous modifications have been put forth in their development - both in the processing sequence as well as in the formulations of corrosion-resistant nano-coating. A variety of surface treatment techniques and nano-coating systems on metallic surfaces has been, and is being, developed. One of them is the appliance of coating with a high concentration of cerium oxide nanoparticles.

Corrosion resistance is essential for metals used in a wide range of applications, from electronics to aviation to power plants. Traditionally, compounds containing a toxic form of chromium have provided the best corrosion resistance. Scientists looking to develop chromium-free alternatives have been unable to achieve the thin layers desirable for many applications. Ultrathin coatings reduce the amount of material needed to provide corrosion resistance, thereby reducing the cost.

Among the key factors that ensure the maximum corrosion-mitigating performance of these ultrathin coating films are the great water-repellency, the deposition of metal oxide nanoparticles over the metal's surface, and their excellent adhesion to metal. The combination of these factors considerably decreased the corrosion of metals. The corrosion resistance of these coatings can be comparable, and even superior, to chromium-based coatings. In fact, this new coating technique provides even better coverage of metal surfaces than chromium coatings. This is particularly advantageous when the metal to be coated possesses fine structural detail.

To select the best and optimize the techniques and materials a reliable and efficient corrosion resistant characterization method is urgently needed. Nano-coating technique has recently emerged to challenge the existing ones taking into account the demand for more effective, more eco-friendly anti-corrosive coatings.

Thus, extending corrosion resistant nano-coating technology is to develop products that deliver high performance in a cost effective solution.