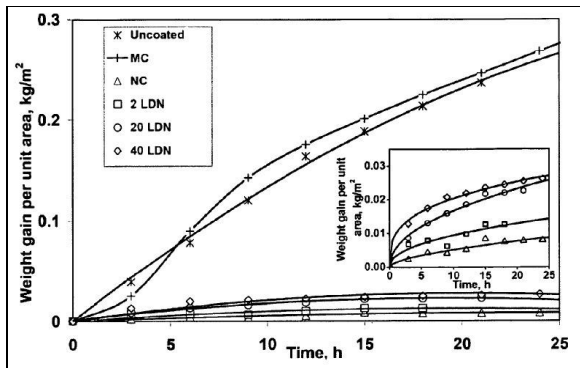


Nanoparticle Coating that Increases the Oxidation Resistance of Stainless Steel at Extremely High Temperatures



Weight Gain Per Unit Area, Versus Time Plots For Isothermal Oxidation Of AISI 304 SS At 1243 Kin Dry Air For 24 Hours

The invention provides a method for increasing the oxidative resistance of stainless steel under high temperature conditions by coating with lanthanide doped nanocrystalline ceria particles

The invention provides the means to create composite nanoparticles that can be applied as coatings onto metals and alloys that already incorporate oxide films. These coatings will enable the materials to resist oxidative stress under the most demanding service conditions. Examples include iron-chromium and iron-chromium-nickel stainless steels (i.e., both ferritic and austenitic alloys) and most other alloys that are dependent on chromium for their corrosion/ oxidation resistance.

Technical Details

Coating metals and alloys with ceria nanoparticles has shown to confer unique properties that are not exhibited by the compound's large-scale counterpart. Such properties include UV protection, catalysis and high-temperature oxidation

resistance. Recent studies have shown that the integration of nanoceria particles with other compounds within the lanthanide elemental series confers an even greater protection against UV and oxidative damage. While traditional oxide films are sufficient for fighting high-temperature oxidation under normal circumstances, they tend to crack under various isothermal and thermal cycle conditions due to thermal stresses and grain growth.

Benefits

- Increases high-temperature oxidation resistance without cracking or spalling
- Coatings are inexpensive to manufacture and apply
- Provides oxidative protection in high temperature environments (up to 1243 K/ 1778 F/ 970 C)
- Increases stainless steel's oxidative resistance by more than 90%

Applications

- Coating stainless steel, as well as other metals, in order to prevent oxidation at high temperatures
- Increase longevity and efficiency of exhaust systems, automotive trim, cookware, and a variety of other industrial processing components (such as those needed in glass melting, chemicals production, metals refining and pulp/paper processing)

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