New multipurpose coating systems based on novel particle technology for extreme environments at high temperatures

Results in Brief

Particle processing improves coatings

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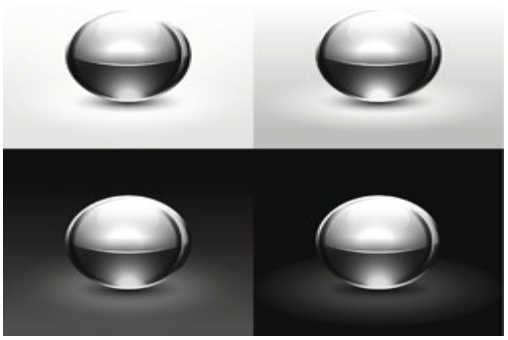
INDUSTRIAL TECHNOLOGIES



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Gas and steam turbines for power generation, aero-engines, chemical reactors and construction materials all rely on thermal barrier coatings. They are widely used and the market potential for improved coatings with better performance at a lower cost is significant.

EU-funded scientists initiated the project PARTICOAT to produce a single coating combining features of high-temperature protection, fire protection and high-temperature electrical insulation. The team achieved all original goals set forth in the project proposal with a variety of coating solutions.

Researchers chose aluminium micro-particles in the range of 1 - 20 micrometres. They successfully bonded the particles to the substrate surface. The heat treatment

used also helped create hollow oxide spheres from the original metallic particles to form a foam-structured topcoat. A diffusion layer was formed beneath the topcoat serving simultaneously as a bond coat for the topcoat as well as a corrosion protection layer.

Testing of high-temperature heat resistance of the aluminium-based coatings demonstrated reduction of temperature up to 25% with a top coat thickness of 170 micrometres. The coatings adhered well to the substrates and were also resistant to scratching. Investigators used oxidised aluminium micro-particles to produce an inner layer and other particles implanted in an outer flame-retardant layer for two different fire-protection coating solutions. They both passed flame resistance and heat protection tests and an industrial scale production procedure was defined for both.

Scientists developed three coating solutions for copper electrical conductors used in high-temperature heating elements. Having passed all tests for scratching, adhesion, erosion, flame-resistance and electrical resistivity, the concepts are proceeding to in-field testing.

PARTICOAT successfully demonstrated thermal barrier coating concepts in which a bond coat and topcoat system is formed in one thermal treatment step. The use of spherical aluminium particles enables the formation of the bond coat and their oxidation creates hollow spheres that act as a thermal barrier. These low-cost multi-functional coatings are already of interest to partners for use in pre-combustion components and thermocouple tubing.

Keywords

High-temperature protective coatings | multi-functional formulations | thermal barrier | fire protection | electrical insulation | aluminium | micro-particles | hollow oxide spheres

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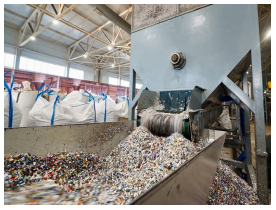

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Project Information

PARTICOAT

Funded under

Grant agreement ID: 211329

Project website

Project closed

Start date
1 November 2008

End date
31 October 2012

Specific Programme "Cooperation": Nanosciences, Nanotechnologies, Materials and new Production Technologies

Total cost
€ 6 893 653,39

EU contribution
€ 4 800 000,00

Coordinated by
FRAUNHOFER GESELLSCHAFT ZUR FORDERUNG DER ANGEWANDTEN FORSCHUNG EV
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