

Composite coating for HT oxidation and molten Al corrosion protection of graphite parts in the aluminium industry.

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Aluminum is the world's most produced non-ferrous metal and the most widely used light metal. Its production require vast amount of energy for melting, casting and rolling. The ACHIEF European project is developing new systems to reduce the CO₂ emissions and energy consumption in Energy Intensive Industries (EIs). In its collaborative effort with partners from the aluminium industry, ACHIEF's main objectives are to decrease maintenance costs for casting line parts and graphite rotors for the degassing process.

Graphite is a choice material due to it lightweight, mechanical properties and inertness, even at high temperature, therefore it is used in a wide range of processes at high temperature or in harsh environments. However, production of graphite is a highly energy intensive process, and therefore, the protection of graphite industrial components is critical for the competitiveness of the processes and for energy savings.

In ACHIEF we have developed protective composite coatings and applied them on degassing rotors in graphite. Protective coatings on graphite for high temperature oxidative or corrosive applications are generally made of SiO₂/SiC multilayers, oxides or nitrides, deposited by PVD or spray technologies [1], [2], [3], [4]. Our coatings were synthesized using the preceramic polymer route in which we used a commercial polysilsesquioxane polymer with adequate fillers, to obtain a composite coating with unique properties after pyrolysis of the pre-ceramic polymer. These coatings were deposited at lab scale by tape casting or brush painting and on industrial scale parts by spray technologies.

They were evaluated in high temperature oxidation conditions (700°C) where they led to a 400% lifetime increase for coated parts, and in a molten Aluminum bath.

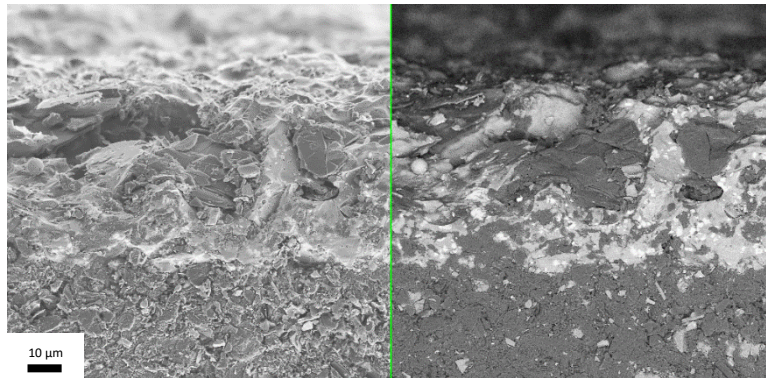


Figure 1. Composite coating from preceramic polymer precursor. SEM image in SE (left) and BSE (right) of coated graphite sample

References

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