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Corundum plasma ceramic products with gradient channel porosity: Advantages and application

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Thanks to its excellent chemical, radiation and heat resistance properties and high mechanical strength, corundum ceramics is versatile for use in a large variety of applications. Emphasis is placed on products with gradient porosity. Plasma spraying proved to be one of the most promising methods for the production of products with gradient porosity. It was established experimentally that the change of some traditional spray coating parameters can result not only in the required integral porosity value, but also in the formation of a pore space, which appears as a system of well-organized channels with a porosity gradient, i.e., the channel size increases to the periphery of a product. Corundum plasma ceramic materials are applied as membranes to the separated anode and cathode spaces and in the creation of electrolysis cells used with aqueous electrolytes and melted media. In particular, we actively participated in the development, production and commercial testing of electrolysis cells used for cerium oxida-tion in nitrate solutions and for electrochemical refining of nonferrous metals in salt melts, where we applied corundum membranes with channel porosity instead of ion-exchange membranes. This enabled us to (1) achieve current efficiency of up to 90% and substance ef-ficiency of up to 97 – 98 % at optimal energy consumption, and (2) reduce energy intensity of the process and save on electrolyte. New three-chamber electrodialysis cells are currently be-ing developed. Their anode and cathode spaces will be separated from the receiving chamber by porous ceramic membranes. Products made from plasma ceramics with gradient porosity are promising as hot gas/aggressive liquid/molten salt filters. They can be used in the design of catalytic reactors, where corundum ceramics will be an ideal chemically inert media capable of intense regeneration.

Biography

A V Ermakov graduated from UrFU (former Ural State Technical University named after S.M. Kirov), Metal Industry department, in 1979. In 1989, he defended a PhD thesis in Engi-neering Science on the topic: “Development of technology for production of semi-finished products from iridium single crystals of a given crystallographic direction”. Since 2007, he has held a position as a General Director of JSC Ural Innovative Technologies. He is the author of over 100 scientific papers and the holder of 67 invention certificates and patents.

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