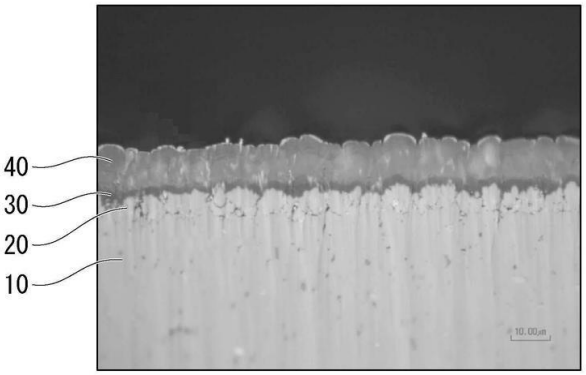
Tohoku Univ. Technology

Multilayer ceramics and methods of production

Improves the coating of metals and metal compounds, prevents peeling and cracking, and ensures corrosion resistance!



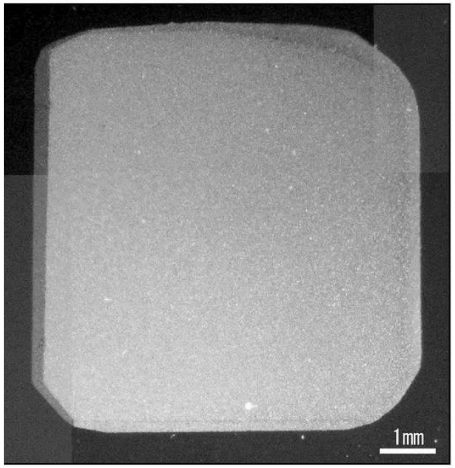
10.Substrate (SiC)
20.CVD-SiC layer
30.Buffer layer
40.Coating layer (alumina)

Overview

Silicon carbide materials and silicon carbide fiber-reinforced composites are expected to replace Zircaloy and other metals as structural materials for next-generation nuclear reactors. However, these materials require anticorrosion coatings when they are exposed to radiation, high temperatures, and high-pressure water. Although metal coatings have been used in the past, there has been a problem that they cannot fully exert their anticorrosion function due to delamination and cracking of the substrate caused by thermal expansion coefficient differences and swelling differences.

A silicon carbide layer, an intermediate layer and a coating layer are laminated on a substrate. As a result, it has become possible to provide a silicon carbide material or a silicon carbide fiber-reinforced composites composed of full ceramics with improved anticorrosion function by alleviating thermal expansion coefficient difference and swelling difference with a base material.

Corrosion test



Even after the corrosion test, the coating did not peel off and no trace of corrosion was observed.

Note that the corrosion test was carried out by immersing the multilayer ceramics in water at a temperature of 320 ℃, a pressure of 11 MPa, and a dissolved oxygen concentration of 8 ppm for 72 hours.

Product Application

- Next generation light-water reactor and Small Modular Reactor、Reduced-Moderation Water Reactor、Micro Modular Reactor
- Nuclear fusion reactor and geothermal plant

Related Works

[1] Sosuke KONDO, Corrosion of SiC and Development of Corrosion Protection Technology for Ceramics, J. Plasma Fusion Res. Vol.98, No.8 (2022) 338-343
[2] Sosuke KONDO, Hirokazu KATSUI and Kazuya SHIMODA, Development of Corrosion-Resistant Coating Technology for Ceramic-Based Nuclear Reactors, J. Surf. Finish. Soc. Jpn., Vol.74, No.12, 2023 Pages 666-672

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