

عنوان مقاله:

Synthesis of Nanostructured ZrC Coating by Electrolysis

محل انتشار:

دوازدهمین سمینار سالانه الکتروشیمی ایران (سال: 1395)

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خلاصه مقاله:

Zirconium alloy due to low thermal expansion coefficient and neutron absorption coefficient is used as clad of fuel in nuclear fission reactors. Coating can be used to extend efficiency of the Zr cladding and also reduce its corrosion. One of the applications of transition metal carbide is use of zirconium carbide in nuclear fuel cladding (1). In this study nanostructured zirconium carbide (ZrC) coating was synthesized on the zirconium by electrolysis of molten salts. For the synthesis of zirconium carbide, NaF (99%, Merck), KF (99%, Merck), ZrO₂ (99.5%, Made in China), Na₂B₄O₇.10H₂O (99.5%, Merck) and Na₂CO₃.H₂O (99.5%, Merck) were used with (18/44, 13/54, 1/58, 32/59, 33/84) wt%, respectively (2). ZrO₂ as a source of zirconium and Na₂CO₃ were used as a carbon source. The mentions salts were poured into platinum crucible and inserted inside outdoor furnace in 772 °C temperature. Zirconium cladding as the cathode and platinum crucible as the anode for electrolysis was used. Using the power supply DC, electrolysis operation was done with current density 150 mA /cm². In the presence of argon gas at the time 180 minutes. The coating was characterized by scanning electron microscopy (ZEISS, EV018 model) and X-ray diffraction (H2E-STOE-Germany, STIDY-MP model). In this study nanostructured zirconium carbide (ZrC) coating was synthesized on the zirconium cladding by electrolysis of molten salts. Coating characterization was performed using XRD and SEM. Formation of zirconium carbide coatings with nano-structure confirmed by using XRD. The results were shown that the average crystallite size and the average thickness of the coating, 71 nm and 98 μm, respectively. X-ray diffraction patterns ZrC coated on the zirconium shown in Figure 1. Zirconium carbide peak in positions $2\theta \approx 32.6, 38.5, 55.5, 65.8, 69.1$ to be seen in this sample is to show the formation of ZrC crystal plates (3-4). Using the Scherrer equation, the crystallite size was calculated below 60 nm that indicates a nanostructure coating is synthesized. Other peaks observed in XRD is related to zirconia. SEM image of ZrC coating in current density 150 mA/cm² was shown (Fig. 2). The average particle size of ZrC was 71 nm. The coating was formed from agglomerates of nanoparticles of zirconium carbide. The average thickness of the coating was 98 μm.

کلمات کلیدی:

Electrolysis, Nanostructured, ZrC, XRD, SEM

لینک ثابت مقاله در پایگاه سیویلیکا:

