

Technical Meeting on Advanced Technology Fuels: Progress on their Design, Manufacturing, Experimentation, Irradiation, and Case Studies for their Industrialization, Safety Evaluation, and Future Prospects

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The study on the interdiffusion performance of Cr-Zr under high temperature in Cr-coated cladding

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Abstract: The Cr-coated cladding has excellent corrosion resistance and good bonding performance with zirconium alloy matrix, and has become the most promising material selection for ATF cladding in engineering applications. Due to the fact that the Cr-coated cladding is obtained by preparing a layer of Cr coating on the outer surface of the traditional zirconium alloy cladding, the intermediate phase formed by the diffusion of Cr-Zr interface at high temperature may cause the coating to crack or peel off, and the diffusion behavior of Cr-Zr at high temperature will also consume the thickness of the Cr coating, thereby affecting the service performance of the Cr-coated cladding. It is necessary to study the interdiffusion behavior of Cr-Zr at high temperature in order to understand the high-temperature performance changes of Cr-coated cladding and promote its engineering applications.

To study the diffusion behavior of Cr-Zr at high temperature and obtain the structural changes, diffusion layer thickness changes, and Cr coating consumption rate during Cr-Zr interdiffusion, This report conducted annealing tests on Cr-coated cladding at different temperature. The experimental results indicate that as the annealing temperature increases, the thickness of the Cr-Zr intermediate diffusion layer will increase, and larger thickness of intermediate diffusion layer will cause internal cracking and lead to coating failure. This report is based on the residual Cr coating thickness and intermediate layer thickness of samples annealed at different temperatures, and obtains the diffusion activation energy and factor of Cr coating, which can provide support for the subsequent calculation of Cr coating consumption rate.

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