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A study on the development of molybdenum and silicide based coatings on Nb based structural materials for advanced high temperature reactor

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The Nb-1Zr-0.1C alloy, owing to its good metallurgical properties, such as high temperature strength and high melting temperature, is proposed as a candidate material for structural applications in the next generation high temperature reactors. This alloy, however, exhibits poor oxidation resistance at elevated temperatures (T> 673 K) which limits its application. Therefore, to use this material for high temperature applications it is required to protect it against oxygen invasion. For this purpose, the approach of applying a silicide coating on the surface which restricts direct contact of oxygen with the substrate is being studied. In our previous work, it was found that only silicide coated Nb alloy samples could not protect the alloy efficiently at high temperatures. Therefore, in the present study attempts have been made to develop $MoSi_2$-$NbSi_2$ coating on the Nb-1Zr-0.1C alloy using NaCl–KCl–NaF–Na_2SiF_6–Si melt. Microstructural characterization of the coated samples was carried out using scanning electron microscopy (SEM) and X-ray diffraction (XRD). Also, XRD pattern obtained revealed the presence of $NbSi_2$ and $MoSi_2$ as a major phase. Isothermal weight gain experiments were carried out on bare Nb and coated sample at 1273 K to evaluate the oxidation performance. Microstructural characterization of all the oxidized samples was carried out using the above mentioned techniques. In addition, the various oxide phases formed on the coated Nb alloy substrate have been identified using XPS (X-ray photo spectroscopy) analysis. The samples coated with silicide and molybdenum showed better oxidation resistance than the bare Nb alloy and Nb alloy coated with silicide only. Characterization of all the oxidized samples was carried out using the above mentioned techniques. In addition, the various oxide phases formed on the coated Nb alloy substrate have been identified using XPS (X-ray photo spectroscopy) analysis. The samples coated with silicide and molybdenum showed better oxidation resistance than the bare Nb alloy and Nb alloy coated with silicide only.

Recent Publications

1. Megha Tyagi, B Vishwanadh, S K Ghosh and R Tewari (2016) A study on reaction kinetics and development of silicide coatings on the Nb-1Zr-0.1C alloy by molten salt technique. RSC Advances 6:99331–99338.
2. Megha Tyagi, B Vishwanadh, S K Ghosh and R Tewari (2015) Synthesis and characterization of silicide coating on niobium alloy produced using molten salt method. Materials Science Forum 830–831:683–686.
3. Megha Tyagi, Bharat A Bhanavase and Shekhar L Pandharipande (2014) Computational studies on release of corrosion inhibitor from LbL assembled nanocontainer. Industrial & Engineering Chemistry Research 53:9764–9771.

Biography

Megha Tyagi has her expertise in the development of high temperatures coating using molten salt technique. She has developed this molten salt technique to coat Si on niobium based alloys. She also has expertise in material characterization and has experience of handling various equipment.

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