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Novel Ir-X thermal protection coatings designed for extreme aerodynamic heating environment

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Novel Ir-X Thermal Protection Coatings Designed for Aerospace Heating Environment
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Abstract
Though being promising in ultra-high temperature application, Iridium coating exhibit low emissivity(ε) and high catalycity(γ) in dissociative atmosphere, which lead to additional heat for hypersonic application. By adding alloy elements X (Al, Cr, Zr…) through pack cementation, Ir-X diffusion coatings were prepared to improve the above properties. Microstructure, element distribution of Ir-X coating were characterized and ε and γ of the coatings were measured. The results showed that Ir-X coatings had a much lower catalycity and higher emissivity, and meanwhile decreased surface temperature in dissociative environment.

Results & Discussion

- Coating Microstructure

Several Ir-X diffusion coatings were prepared through pack cementation.

- Coating Emissivity

The results showed that Ir-X coatings had a much lower catalycity and higher emissivity, and meanwhile decreased surface temperature in dissociative environment.

- Coating Surface Recombination

Spectrum of O and Ir-X coating in dissociative O/Ar without heating

Conclusions
Ir-X(X=Al, Cr, Zr, Y, Ta) intermetallic coatings with compact single or multilayer scale could be prepared through pack cementation.
After cementation, Ir-X diffusion coating could largely increase emissivity and decrease catalycity, resulting in a lower surface temperature at dissociative atmosphere.

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