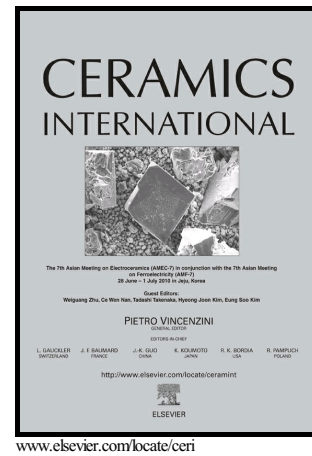


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Solidification mechanism and microstructure evolution of Al₂O₃-ZrO₂ ceramic coating prepared by combustion synthesis and thermal explosion spraying

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Abstract:

The solidification mechanism and microstructure of the hypoeutectic Al₂O₃-ZrO₂ (Al₂O₃:72mol%) ultra-fined ceramic coating prepared by combustion synthesis and rapid plate cooling method were analyzed by the heat transfer process and dynamic characteristics. The rapid solidification process inhibited the transformation from the t-ZrO₂ to m-ZrO₂ at low temperatures. The growth rate of the solid-liquid interface to form the amorphous and nano-crystalline Al₂O₃-ZrO₂ was about 65.7mm/s and 13.7mm/s, respectively. The mechanism formation of both the amorphous and nano-crystalline areas were analyzed using rapid solidification models. When the growth rate reduced to about 8.23mm/s, large quantities of nanosized eutectic structures was identified by SEM in the pseudo-eutectic area. The interphase spacing of the eutectic structures was 40~100nm. In addition, some typical divorced eutectic structures appeared at this area. After that, micron dendrites (0.2~0.6μm) took the main part when the growth rate decreased to about 3.67mm/s for such a hypoeutectic Al₂O₃-ZrO₂ binary system. The nano-crystalline area showed the highest nanohardness (22GPa). This paper may provide new guidance to prepare high performance Al₂O₃-ZrO₂ ceramics both in experiment and theory.

Keywords:

Microstructure evolution; Rapid solidification; Al₂O₃/ZrO₂; Ultra-fined ceramic coating.

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