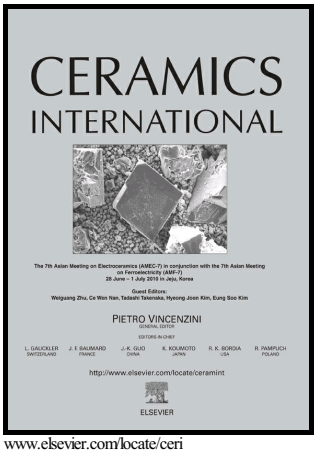

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PII: S0272-8842(16)32167-8
DOI: http://dx.doi.org/10.1016/j.ceramint.2016.11.153
Reference: CERI14241

To appear in: *Ceramics International*

Received date: 21 October 2016
Revised date: 31 October 2016
Accepted date: 22 November 2016

Cite this article as: Jiayu Pan, Yongting Zheng, Yuandi Zheng, Wei Ye and Wanjun Yu, Solidification mechanism and microstructure evolution of Al $_2O_3$ ZrO_2 ceramic coating prepared by combustion synthesis and thermal explosio s p r a y i n g , *Ceramics Internationa* http://dx.doi.org/10.1016/j.ceramint.2016.11.153

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Abstract:

The solidification mechanism and microstructure of the hypoeutectic Al_2O_3-ZrO_2 (Al_2O_3:72mol%) 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-ZrO_2 to m-ZrO_2 at low temperatures. The growth rate of the solid-liquid interface to form the amorphous and nano-crystalline Al_2O_3-ZrO_2 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 Al_2O_3-ZrO_2 binary system. The nano-crystalline area showed the highest nanohardness (22GPa). This paper may provide new guidance to prepare high performance Al_2O_3-ZrO_2 ceramics both in experiment and theory.

Keywords:

Microstructure evolution; Rapid solidification; Al_2O_3/ZrO_2; Ultra-fined ceramic coating.