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PII:	S0257-8972(17)31130-1
DOI:	doi:10.1016/j.surfcoat.2017.11.008
Reference:	SCT 22856
To appear in:	*Surface & Coatings Technology*
Received date:	28 July 2017
Revised date:	31 October 2017
Accepted date:	2 November 2017

Please cite this article as: Fabien Blas, Florence Ansart, Philippe Lours, Jean-Pierre Bonino, Sandrine Duluard, Vanessa Vidal, Lisa Pin, Guillaume Pujol, Luiza Bonin , Processing thermal barrier coatings via sol-gel route: Crack network control and durability. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), doi:10.1016/j.surfcoat.2017.11.008

Processing Thermal Barrier Coatings via sol-gel route: crack network control and durability

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Abstract

Thermal barrier coatings (TBC) processed by sol–gel route are deposited onto NiPtAl bond coated superalloy substrates. A crack microstructure, if well controlled, is adequate to get satisfactory thermo-mechanical behaviour when the TBC is cyclically oxidized. This paper deals with the adjustment of the properties of the micro-cracked network which is inherent to the process by changing the formulation of the sol and by adding a reinforcement step. The objective is to reduce the size and depth of the surface cracks network. This network controls the release of thermo-mechanical stress in the layers and reduces detrimental propagation of cracks that could result in the spallation of the coatings during engine operation. Several physico-chemical characterizations were performed, associated to image analyses to (i) evaluate the cracks distribution (depth, length and width), in the case of two dispersants, and (ii) to estimate their influence on the performances of TBC systems. Characterizations by