

## SEGMENTATION CRACKS IN PLASMA SPRAY COATINGS: FORMATION DYNAMICS AND CHARACTERIZATION

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Segmentation cracks in Air Plasma Sprayed (APS) Thermal Barrier Coatings (TBCs) have been recognized as crucial micro-structural asset for increasing the in-plane strain tolerance of the coatings and thus enhancing the TBC durability. These vertically cracked coatings also show excellent in-plane fracture toughness. This combination has allowed wide spread use of these coatings in gas turbine engines. Although industrially successful, there is limited scientific studies on the formation dynamics of such cracks, and their relationship to process conditions and performance. This is especially of importance as efforts are underway to find alternative to Yttria Stabilized Zirconias for higher temperature thermal barrier applications.

This study seeks to characterize the formation dynamics of such cracks through monitoring of real time curvature evolution of a beam during plasma spraying. The concept here is to understand stress evolution from the curvature measurements which then will allow identification of conditions at which cracks initiate and progress through successive coating build up. Examples are presented for Yttria Stabilized Zirconia as well as Gadolinium Zirconate and Titanium Oxide.

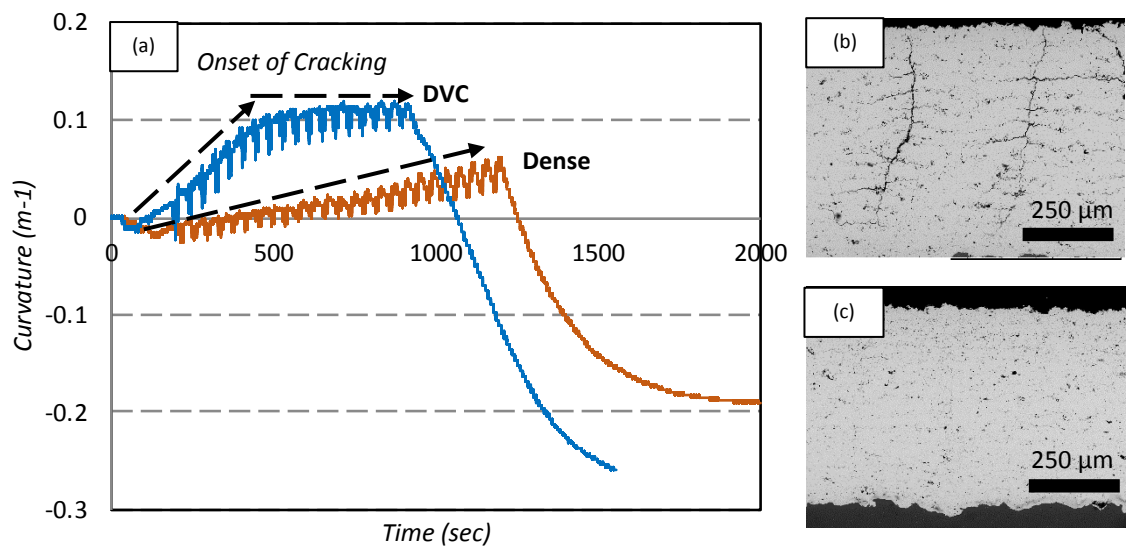


Figure 1: The change in evolving stress on onset of cracking as monitored by an ICP sensor for the as-sprayed YSZ coatings (a) Curvature - Time data and the corresponding microstructure of (b) Segmented (Vertically Cracked) coating (c) Dense coating.