

Accepted Manuscript

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PII: S0257-8972(18)30003-3
DOI: <https://doi.org/10.1016/j.surfcoat.2018.01.003>
Reference: SCT 22986
To appear in: *Surface & Coatings Technology*
Received date: 8 July 2017
Revised date: 31 December 2017
Accepted date: 2 January 2018

Please cite this article as: Sen-Hui Liu, Cheng-Xin Li, Lu Li, Jia-Hua Huang, Pan Xu, Ying-Zhen Hu, Guan-Jun Yang, Chang-Jiu Li , Development of long laminar plasma jet on thermal spraying process: Microstructures of zirconia coatings. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Sct(2017), <https://doi.org/10.1016/j.surfcoat.2018.01.003>

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Development of Long Laminar Plasma Jet on Thermal Spraying Process: Microstructures of Zirconia Coatings

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Abstract:

A novel direct current non-transferred arc plasma torch that can generate long, silent and stable laminar plasma jet in air is applied to thermal spraying process in this article. Such long laminar plasma jet, making a low level of noise (<80 dB) in air, features a jet length over 350 mm, and presents regular variation in length with the increase of output power and gas flow rate. Microstructures and properties of YSZ coatings obtained under spraying distances ranging from 130 mm to 300 mm are discussed in the following. The results show different intervals of vertical cracks across the transverse sections of the coatings and orderly distributed island-protrusions on the top surface of the coatings. A mass of vapor deposited structures can be found in the samples, that means the refractory 8YSZ powders can be melted sufficiently when flowing in long laminar plasma jet, even up to the boiling point, although the stable output power of the laminar plasma torch is only 25-26 kW during the spraying process. This may provide extensive options for different plasma spraying applications and improve the controllability of plasma spraying technology.

Keywords: Laminar Plasma Jet; Thermal Spraying; YSZ Coatings; Vertical Cracks; Thermal Conductivity.

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Abbreviations: SEM, scanning electron microscopy; XRD, X-ray diffraction; SPPS, solution precursor plasma

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