

Abstract Submitted  
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**DBD Actuated Flow Control of Wall-Jet and Cross-Flow Interaction for Film Cooling Applications**<sup>1</sup> RAKSHIT TIRUMALA, NICOLAS BENARD, ERIC MOREAU, MATTHIEU FENOT, GILDAS LALIZEL, EVA DORIGNAC, Institut PPRIME, Université de Poitiers (CNRS UPR 3346, ISAE-ENSMA), Boulevard Marie et Pierre Curie, BP30179, 86962 Futuroscope, France — In this work, we use surface DBD actuators to control the interaction between a wall jet and mainstream flow in film cooling applications. The intention of the study is to improve the contact of the jet with the wall and enhance the convective heat transfer coefficient downstream of the jet exit. A 2D wall jet (10 mm height) is injected into the mainstream flow at an angle of 30°. With an injected jet velocity ( $U_i$ ) of 5 m/s, two blowing ratios  $M (= \rho_i U_i / \rho_\infty U_\infty)$  of 1.0 and 0.5 are studied corresponding to the mainstream flow velocity ( $U_\infty$ ) of 5 m/s and 10 m/s respectively. Different configurations of the DBD actuator are studied, positioned both inside the jet and on the downstream side. PIV measurements are conducted to investigate the flow field of the interaction between the jet and cross flow. Streamwise velocity profiles at different downstream locations are compared to analyze the efficacy of the plasma actuator in improving the contact between the injected jet stream and the wall surface. Reynolds shear stress measurements are also conducted to study the mixing regions in the plasma-jet-mainstream flow interaction.

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