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Vane Separation Control in a Linear Cascade with Area Expansion using AC DBD Plasma Actuators CHRISTOPHER KLEVEN, THOMAS CORKE, University of Notre Dame — Experiments are presented on the use of AC dielectric barrier discharge (DBD) plasma actuators to prevent flow separation on vanes in a linear cascade with area expansion. The inlet Mach number to the cascade ranged from 0.3 to 0.5, and the vane chord Reynolds numbers ranged from 0.9×10^6 to 1.5×10^6. Three cascade designs with different amounts of area expansion, providing different degrees of adverse pressure gradients, were examined. Surface flow visualization revealed a 3-D separation bubble with strong recirculation that formed on the suction side of the vanes. The pattern agreed well with CFD simulations. Plasma actuators were placed on the suction sides of the vanes, just upstream of the flow separation location. Quantitative measurements were performed in the wakes of the vanes using a 5-hole Pitot probe. The measurements were used to determine the effect of the plasma actuator separation control on the pressure loss coefficient, and flow turning angle through the cascades. Overall, the plasma actuators separation control increased the velocity magnitude and dynamic pressure in the passage between the vanes, resulted in a more spanwise-uniform flow turning angle in the vane passage, and significantly lowered the loss coefficient compared to the baseline.

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