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## **C1Po3D-01: Design and performance analysis: characteristics of multi-dimension helium turbine brake wheels based on CFX simulation**

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Helium turbine expanders are widely used in low-temperature refrigeration applications, and the efficiency and performance of their brake impellers directly impact the overall equipment efficiency and stability. This study employs the computational fluid dynamics (CFD) software ANSYS CFX to analyze the performance characteristics of ten brake impellers of varying sizes in helium turbine expanders at different rotational speeds. It examines how the impeller outlet diameter and the number of impellers affect the pressure ratio, isentropic efficiency, and brake power within the stable operating range of the brake impeller. The results indicate that increasing the outlet diameter significantly enhances both the stable operating range and brake power of the brake impeller, while the efficiency remains relatively unchanged. Additionally, increasing the number of impellers expands the stable operating range without significantly affecting efficiency, although the impact on brake power is less pronounced compared to changes in outlet diameter. Through the analysis of brake impellers of multiple sizes, this study provides a method to optimize brake impeller performance without altering the impeller design.

Keywords: brake impeller, multiple sizes, CFD simulation, performance analysis

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