

MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Interactive Presentations (IP)

Author: Mr. Jinlong Peng  
China Academy of Aerospace Aerodynamics (CAAA), China, fzp\_86@126.com

Mr. Lian-zhong Chen  
China Academy of Aerospace Aerodynamics (CAAA), China, agent9@sina.com

Mr. Jian-qiang Tu  
China Academy of Aerospace Aerodynamics (CAAA), China, tujianqiang0806@163.com

Prof. Yonghui Dong  
China Academy of Aerospace Aerodynamics (CAAA), China, yhdong@189.cn

Mr. Dongbin Ou  
China Academy of Aerospace Aerodynamics, China, oudongbin@sina.com

EFFECT OF RECTANGULAR NOZZLE WATER-COOLING WALL ON THE TOTAL ENTHALPY  
LOSS OF HIGH TEMPERATURE AIRFLOW IN ARC-HEATED WIND TUNNEL**Abstract**

According to the low redundancy design requirements of hypersonic aircraft, the ground arc-heated wind tunnel simulation test is required to provide accurate enough flow conditions. This paper analyses the effect of rectangular nozzle wall-cooling wall on the total enthalpy loss of high temperature airflow in arc-heated wind tunnel flow condition. Both engineering method model and three-dimensional numerical model are established. The total enthalpy loss of airflow calculated by the engineering method and three-dimensional numerical method is 3% and 2.5% respectively, under the airflow condition that the total pressure of the airflow is 0.52MPa with total temperature of 1629K. This shows that the precision of the engineering method is acceptable, and the error is mainly from the piecewise given nozzle wall heat flux. A parametric study is performed with effect of rectangular nozzle wall-cooling wall on total enthalpy loss of high temperature airflow, under different airflow conditions of different total enthalpy which are used to simulate different Ma numbers (Ma=6,8,10) of the flying conditions on hypersonic aircraft. Therefore, in the process of test, need to consider the water-cooling wall effect of nozzle on the total enthalpy airflow loss according to the specific test condition.