

## **Application Optimization of Two-Dimensional Nozzle with Alloy Steel Structure in the Supersonic Wind Tunnel**

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The two-dimensional nozzle is an import part of supersonic wind tunnels to obtain the flow field with designed Mach number, and the structure of nozzles has direct influence on the uniformity of flow field. Usually, for easy construction and convenience in the two-dimensional nozzle, epoxy resin is adopted in the structural design as the material. However, because of the difference linear expansion coefficient between epoxy resin and the steel framework, often the separation appears due to the reason, and the expansion and contract caused by the heat and cold air flows during the operation of wind tunnel, there often appear some cracks on the edges and body of the nozzle made of epoxy resin; due to the large size of particle contained in the air flow, there often appear some nicks on the nozzle contour. The cracks and nicks will bring about shock waves in the flow field which has disadvantageous effect on the quality of flow field. In order to eliminate the shortcoming caused by the epoxy resin, we have comprehensive consideration of various factors in the two-dimensional nozzle design of 1.2 m x 1.2 m supersonic wind tunnel, making the body structure based on alloy steel for the two-dimensional nozzle design, so a nozzle of steel structure is made with exit size of 1.2m×1.2m and Mach number of 3.5. A great deal of experiments have been conducted on the nozzle, and experimental results show that the flow field of the nozzle is always good. In this paper, the design details of two-dimensional nozzle will be described on the basis of the engineering algorithm, and the stress and deformation analysis is calculated by Ansys, and the calculation results show that two-dimensional nozzle with alloy steel satisfies the design conditions. some typical experimental results of flow fields of the nozzle steel structure are also presented, the nozzle is reliability and easy to use, and the maintainability is very good, the surface strength of two-dimensional nozzle is greatly increased, extend the service life more than 10 years.

**Key words:** Structure, Optimization, Two-dimensional nozzle, Supersonic, Alloy steel