

Research on the Protective Layer of the Wind Tunnel

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Abstract: Wind tunnels are necessary in evaluating the aerodynamic noise, for it can simulate the actual wind conditions. But the wind tunnels still have some problems which have to be overcome. In the measuring section, the background noise of the wind tunnel includes not only the noise generated locally but also the aerodynamic noise propagated through circuit ducts of the wind tunnel. It is necessary to reduce these noises when testing the aerodynamic noise of the devices-under-testing.

Aerodynamic noise is generated by the fluctuating pressure on the body surface and the vortex shedding and turbulent vortex motions around bodies are responsible for it. In other words the aerodynamic noise is caused by the generation, acceleration and interaction of vortices. In order to alleviate such vertical motions, the shape of body is carefully designed, but we still need to find a kind of material that can reduce the aerodynamic noise effectively.

In this paper, different materials with different density, fiber length, stiffness were alternately attached to the inner surface of the nozzle and collector. For the material put on the surface can alleviate the wake shear and reduce the turbulent noise, we use the microphone array system to measure the background noise for different material used on the surface of the nozzle and collector. In such a way, we can get those materials noise reduction capability in the tunnel and we can choose one material that can ultimately reduce the aerodynamic noise for the wind tunnel.

Also, the material's installation mode is very important. The traditional way the surface of the wind tunnel is made with glass wool and perforated plates, based on past experience the fiber under the perforated plate can leak easily, and the structural strength still need to be enhanced. Therefore, in order to alleviate these defects, we make some improvement on the materials installation mode on the wall of the wind tunnel. First, the perforated plate is bending to enhance the structural strength. Second, we fixed a kind of porous material on the surface of the perforated plate for it can avoid the fiber leaking from it. Finally, we measured its properties, we found that this mode can not only ensure the aerodynamic noise reducing efficiency, but also improve the mechanical properties, such as, structural strength and adhesive fastness. In addition, the production processing becomes simpler and the cost can be lower.

Keywords: aerodynamic noise; wind tunnel; noise reducing material; installation mode