MECHANICAL PROPERTY RESEARCH OF DIFFERENT MATERIAL AND DIFFERENT SECTION SHAPE SUPPORTING RING

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ABSTRACT
Supporting ring has been applied more widely as assistant structural support. During the engineering design and optimization process, many experiments are needed to research the mechanical properties of different material and different section shape supporting ring. The key problem is to measure the radial force, caused by the elongate under the axes pressure. It cannot be measured directly by use of sensors. The old simple method is to use a transfer-bar, into the hole on the supported wall, or using strain gauge. That will change the contact boundary. A new method, called as ‘semi-ring’ method, is brought forward. The problem can be solved well. The feasibility is revealed by an example of application.

Keywords: supporting ring, contact boundary, butyl rubber, polytetrafluoroethylene.

INTRODUCTION
Structural supporting ring has a broad engineering application as structural transition supports. The action principle is as follows: the structure supporting ring is arranged in the appointed shape of space requirements, axial load is applied to the structure supporting ring, the radial expansion is caused, as thus, the structure will has the function of a radial support. In the structural design and optimization process, it is needed to study the mechanical performance of the structure supporting ring by many laboratory tests. Mainly for the mechanical properties of different materials, different section shape structure bearing rings are compared, such as axial compression with axial load, radial force variation with axial compression volume changes. The axial load, which is applied by material testing machine, can be measured directly by force sensor, and the axial compression can be measured by displacement gauge measurement. The difficulty is to measure the radial force, which is bearing ring radial expansion to be function supports the extrusion of the inner wall. It is impossible to introduce force sensor directly. There have been two traditional methods. One way is to hole in the circumferential direction by the support member, transfer bar is introduced, transmission rod end and the force sensor is connected and fixed by the support member, the other end extends into the circumferential direction of the hole, and the end face is flat with the inner wall of support member. The other way is to introduce a thin layer of pressure sensor between the support member and the inner wall of the supporting ring to measure the radial force directionally. But all of these will change the contact boundary. The two methods have their own shortcomings as follows. For the first method, the main drawbacks are: the radial hole will change the contact boundary; the transmission rod installed into the amount can not be precisely controlled, and that will affect measurement results badly. For the other method, the main drawbacks are: although the inter layer pressure sensor is very thin, the sensor contact pressure will increase, the specific impact cannot be determined; the support ring space is confined, in order to lead out, hole needs to be opened,
the support ring stress situation will be affected. In order to solve these problems, a new measurement method - ‘semi ring’ measurement method is put forward in this paper, and mechanical properties of different material and different section shape supporting ring is researched.

RESULTS AND CONCLUSIONS

A new method is proposed to measure the radial force of supporting ring in mechanics performance test. Comparing with the old methods, support ring and the contact condition of inner wall of the support member is not changed, thereby the authenticity of force can be ensured. On the other hand, the trouble about leading measurement wire can be avoided.

The first specimen, which material is PTFE, axial compression amount, Fig.1, is mainly caused by the deformation of cross section shape, and radial expansion is very small. So the radial supporting force is smaller visibly. For the same material of butyl rubber, the test piece of square section and ‘X’ section can generate larger radial supporting force, but cycloidal section shaped specimen radial supporting force is small. The results can be used to select the material and section shape reasonably in structure design. If it is needed to anti rotation and reduce vibration, butyl rubber square section or ‘X’ section should be chosen for larger radial force, and the difference is that, the axial compression amount of ‘X’ shaped section is larger.

![Fig. 1 - Curve of axial compression changing with axial force](image)

The new method is applied in mechanics performance tests for PTFE and butyl rubber material four kinds of section shape structure supporting rings. The results and analysis can be referenced for structure design.

REFERENCES