THE RESEARCH ON COMPATIBILITY OF INTERFACE DEFORMATION BETWEEN ALUMINUM ALLOY AND COMPOSITE MATERIAL

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For a pressure vessel with ultrathin metal liner, with the internal pressure, Aluminum alloy, carbon fiber together with their bonding interface are subjected to the tensile strain. After unloading the internal pressure,the vessel produces the elastic shrinkage. The shrinkage deformation of Aluminum alloy will be constrained by the composite material so that the Aluminum alloy bears the pressure. This phenomenon makes vessel failure in the course of using. In order to elongate the using life of the vessel, compatibility[1] of the deformation between aluminum alloy and composite material must be ensured. In order to measure the deformation of Aluminum alloy, carbon fiber and bonding interface under repeated load, the specimens of Aluminum alloy and composite materials have been made. Under imitation practice work condition, the specimens bear repeated tensile force, so deformation information of the specimens can be obtained in the course of repeated tensile force[2].

The specimens have been measured with moire interferometry [3]. Before loading, the plane which includes aluminum alloy, carbon fiber and bonding interface has been copied with high frequency grating. This high frequency grating is called specimens grating. The points on the specimen grating are corresponded with the points on the specimens. The specimen grating could express the deformation of the specimen. The full deformation information about all points of the specimen grating from loading to damage can be obtained. The precision [4]of tested deformation of aluminum alloy, carbon fiber and bonding interface is in the range of micrometer.

Because the high accuracy and wide range moire interferometry can not only characterize[5] the deformation of the structural element but also provide the accuracy boundary conditions for finite element analysis. It is called synthesis method of finite element using boundary conditions provided with moire interferometry. Comparing the displacement field obtained by moire interferometry and synthesis method, the results from the two methods are correspondent. This conclusion illustrates that synthesis method has the utility value on the mechanics analysis of engineering structure. This paper can provide theoretical reference to the structural design and evaluation of performance on ultrathin metal liner composite pressure vessel.

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