The Analysis of the Model of Damping Mechanism for Shipborne Labyrinth Compressor Piston Components

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Piston parts of a shipborne labyrinth compressor are mainly composed of a piston and a coated piston rod. In recent years, many studies have shown that the vibration response of coating structure is significantly reduced. Because of the non-contact of the piston, the cylinder case and guide support entirely depends on the piston rod. The lateral jitter can be regarded as the vibration of cantilever beam. However there is no effective method to separate the contribution of hard-coating damping from the damping of composite system. In this paper, based on separating the damping contribution of hard coating, the method of creating the damping mechanism model of piston rod is studied. Firstly, the piston rod before and after coating are tested and the characteristic parameters of vibration, such as natural frequency, damping ratio, vibration response are acquired. Moreover, according to the analysis of the storage and dissipation energy in the uncoated and coated rod, the damping contribution of hard coating has been confirmed. Finally, the Oberst beam theory is adopted to create the damping mechanism model of piston rod which includes both material damping and viscous damping. The correctness of analytical model is also verified by the experiment results.

Keywords: Hard Coating, Piston Rod, Damping Mechanism, Analysis Model, Basement Exciting

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