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EXPERIMENTAL RESULTS OF BUFFING PROPERTY FOR THE TWIP STEEL ROD AND ITS APPLICATION IN CHANG'E-3 PROBE

Abstract

It's an important way for deep space exploration to perform exploring activities on the surface of target celestial body by the soft landing of probe. As one of the most commonly used buffing devices of the soft landing probe, the landing gear's performance will directly affect the success of the soft landing process. It usually absorbs the impact energy through the plastic deformation of the buffer material installed in its interior. The research results show that the aluminum honeycomb is a good kind buffer material for its high ability of energy absorbing, insensitiveness to the space environment factors, stability of buffing performance and the low expense of production. But its strength is just about tens of meta-Pascal during the compression process. When acquiring the high buffing ability, the cross-sectional area of the aluminum honeycomb has to be expanded which means the bulk has to be enlarged. In addition, the aluminum honeycomb can only alleviate the compact load. When the tensile load is to be alleviated, an additional device is needed to transform the tensile load into compact load which exerts on the honeycomb. So extra mass and bulk have to be paid. In order to solving the problem, Wang and Duan suggested a new twining induced plasticity (TWIP) steel. It is easy to use the rod which is made of TWIP to alleviate the tensile impact load. The basic manufacturing process of the rod is introduced in this paper, and the test results of quasi-static stretch and impact are both provided. Then the specific patterns of the rod used to attenuate the impact are addressed with comments and considerations. The application mode of the rod in the Chang'e-3 probe and the impact experimental results at the ground and on the Moon surface are given in the end. Compacted with the aluminum honeycomb the strength of the rod during plastic deformation process is very high. So along with its long elongation the rod can provide high ability of impact energy absorption even with a small cross-sectional area. It is proved by the tests and applications that with the small diameter the rod can pass through the cell of the honeycomb directly and can attenuate the tensile and compact load conveniently with their combination without any other transformational devices. This characteristic is so important to the design of the Moon probe for the bulk and the mass are always controlled strictly.