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固体力学与飞行器总体设计

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## 铝合金焊接接头预腐蚀强度特性及预测

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## Properties and Prediction of Pre-corrosion Strength of Aluminum Alloy Welded Joints

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摘要

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### 摘要

为保证航空航天器中贮存腐蚀溶液的焊接结构的耐久性,有必要对焊接接头预腐蚀强度特性进行研究。首先进行2219-T87铝合金焊接接头试样在酸性模拟溶液中的腐蚀试验,获取焊接接头和母材的腐蚀性能数据;根据腐蚀试验数据,结合焊接接头局部力学试验数据,采用有限元方法对焊接接头预腐蚀强度和断裂位置进行预测;通过焊接接头预腐蚀拉伸试验对预测结果进行验证。研究表明:焊接接头腐蚀性能最主要的特点是焊缝区、热影响区和母材的腐蚀性能存在显著差异;腐蚀性能是影响焊接接头预腐蚀强度的重要因素,且其影响随着腐蚀时间的增加而逐渐增大,导致长时间腐蚀的试样在拉伸试验中的断裂位置由力学性能薄弱的熔合区转移到腐蚀性能薄弱的母材区;所提出的预测方法具有试验规模小、结果准确且适应性强的优点。

关键词: 焊接接头 铝合金 腐蚀 有限元法 耐腐蚀性能

### Abstract:

In order to ensure the durability of welded structures used for long-term storage of corrosive solutions in the aerospace field, it is necessary to study the pre-corrosion strength properties of welded joints. Corrosion tests of welded joint specimens AA2219-T87 are conducted in an acid solution to obtain the corrosion property data of the welded joints and base metal, and the differences of corrosion properties between the welded joint and base metal are summarized. Based on the data of corrosion tests and welded joint local strength tests, a finite element method is used to predict the pre-corrosion strength and fracture position of welded joints, the results of which are verified by pre-corrosion tensile tests. The study shows that the major characteristic of a welded joint's corrosion resistance is the existence of obvious differences of corrosive resistance among the weld zone, the heat affected zone and the base metal. The corrosion resistance is an important factor for the pre-corrosion strength of welded joints, and its influence increases with time, leading to the translocation of fracture positions of long-time corroded specimens from areas of poor mechanical property to areas of poor corrosion property during tensile tests. The proposed prediction method of welded joint pre-corrosion strength can yield accurate results with a minimum number and scale of tests.

Keywords: welded joints aluminum alloy corrosion finite element method corrosion resistance

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