



航空学报 » 2012, Vol. 33 » Issue (8) : 1540-1546 DOI:

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表面织构鞋底流体动压指尖密封的性能分析

郎达学, 苏华

西北工业大学 机电学院, 陕西 西安 710072

Performance Analysis of Surface Texture Padded Finger Seal

LANG Daxue, SU Hua

School of Mechatronics, Northwestern Polytechnical University, Xi'an 710072, China

摘要

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**摘要** 表面织构鞋底流体动压指尖密封是本文提出的一种新型柔性气体密封。建立了具有圆形微坑表面织构鞋底的指尖密封分析模型,采用流固耦合有限元数值计算方法,分析了不同工况和织构结构条件下表面织构鞋底流体动压指尖密封的泄漏率、气膜承载力及气膜流场特征。结果表明具有圆形微坑织构鞋底的指尖密封具有较低的泄漏率和较高的气膜承载力,通过与现有典型人字槽流体动压指尖密封和接触式指尖密封的性能对比,进一步说明了表面织构鞋底指尖密封的综合性能优势。流体压差对表面织构鞋底流体动压指尖密封的性能影响较大;压差较大时,适当增大微坑直径、减小微坑深度、采用均匀分布的微坑结构形式,有利于提高密封性能。本文工作为设计性能良好的指尖密封结构提供了一种新思路。

**关键词:** 指尖密封 表面织构鞋底 流固耦合 泄漏 气膜承载力

**Abstract:** A new type of flexible gas shaft seal named surface texture padded finger seal is proposed in this paper. An analysis model of the padded finger seal with micro circle surface texture is established. By using the fluid-solid coupling finite element numerical calculation method, the seal's leakage, gas film lift capacity and gas film flow field characteristics in different working conditions and variable texture parameters are analyzed. It is shown that the finger seal with micro circle surface texture pad has low leakage and high lift capacity. Compared with the existing typical herringbone groove padded finger seal and the contacting finger seal, the surface texture padded finger seal shows a comprehensive advantage. The performance of a surface texture padded finger seal is influenced by the gas pressure to a much greater degree. When the gas pressure is high, increasing the circle diameter, decreasing the depth of the pit, and distributing the micro circle uniformly, will all improve the performance of the seal. The work presented here provides a new way to design finger seals with high performance.

**Keywords:** finger seal surface texture pad fluid-solid coupling leakage gas film lift capacity

Received 2011-10-25;

Fund: 陕西省自然科学基金计划(2009JM7002)

Corresponding Authors: 苏华 Email: huasu@nwpu.edu.cn

引用本文:

郎达学, 苏华. 表面织构鞋底流体动压指尖密封的性能分析[J]. 航空学报, 2012, 33(8): 1540-1546.

LANG Daxue, SU Hua. Performance Analysis of Surface Texture Padded Finger Seal[J]. Acta Aeronautica et Astronautica Sinica, 2012, 33(8): 1540-1546.

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