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表面与界面工程

斜排微孔端面机械密封富集效应的理论研究

刘鑫，彭旭东，孟祥铠，钟伟明，古通生

浙江工业大学过程装备及其再制造教育部工程研究中心;中国石化股份有限公司广州分公司机动部

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摘要

在周向部分开孔直排微孔端面机械密封富集效应研究的基础上，建立了周向部分开孔斜排微孔端面机械密封的理论分析模型，并采用有限元方法求解雷诺方程，获得了斜排微孔密封的端面液膜压力分布，分析了微孔斜排倾斜角、孔栏数、端面半径比等几何参数在不同转速、不同介质压力等操作条件下对端面液膜刚度、开启力和泄漏率的影响规律，指出了斜排微孔端面密封产生承载力的机理。结果表明，当倾斜角在60°～90°之间取值，且每栏微孔的径向微孔数与周向微孔数相等或相差±1个时，密封综合性能最优。

关键词

机械密封 激光加工 斜排微孔端面 富集效应

分类号

Theoretical study of collective effect of laser surface textured mechanical seal with oblique distributed pore face

LIU Xin，PENG Xudong，MENG Xiangkai，ZHONG Weiming，GU Tongsheng

Abstract

Laser surface texturing (LST) has been used in mechanical seal for nearly 10 years, and the modeling and experiments have been made for determining the dimensions that characterize LST, but many works still remains to be done in choosing suitable texture and optimizing the dimension designs to help retain lubricant and enhances the hydrodynamic effect at the interface in the running fields.Based on the study of collective effect of a laser-textured mechanical seal with a radial distributed micropore face, a theoretical analysis model for a laser-textured mechanical seal with an oblique distributed micropore face was developed, by which the fluid film pressure distribution between the faces was obtained.The variation of fluid film stiffness and opening force with oblique angle, pore column number, and face radial ratio under different operation conditions was studied, and the load carrying capacity and its mechanisms were presented.The results showed that when the oblique angle was between 60°and 90°, both the radial pore number and the circumferential pore number was equal or the number differences were controlled within the range of ±1, excellent sealing performance could be obtained for a laser-textured mechanical seal with an oblique distributed pore face.

Key words

mechanical seal laser surface textured oblique distributed pore face collective effect

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通讯作者 彭旭东 xdpeng@zjut.edu.cn