中国化学工程学报 2007 15 (4): 499-506 ISSN: 1004-616x CN: 44-1063/R

TRANSPORT PHENOMENA & FLUID MECHANICS

螺旋槽机械密封的改进设计

周剑锋, 顾伯勤, 陈晔

Fluid Sealing and Control Laboratory, College of Mechanical and Power Engineering, Nanjing University of Tech-nology, Nanjing 210009, China

收稿日期 修回日期 网络版发布日期 接受日期

摘要 The coupling effect among the flow of fluid film, the frictional heat of fluid film and the thermal deformation of sealing rings is inherent in mechanical seals. The frictional heat transfer analysis was carried out to optimize the geometrical parameters of the sealing rings, such as the length, the inner radius and the outer radius. The geometrical parameters of spiral grooves, such as the spiral angle, the end radius, the groove depth, the ratio of the groove width to the weir width and the number of the grooves, were optimized by regarding the maximum bearing force of fluid film as the optimization objective with the coupling effect considered. The depth of spiral groove was designed to gradually increase from the end radius of spiral groove to the outer radius of end face in order to de-crease the weakening effect of thermal deformation on the hydrodynamic effect of spiral grooves. The end faces of sealing rings were machined to form a divergent gap at inner radius, and a parallel gap will form to reduce the leakage rate when the thermal deformation takes place. The improved spiral groove mechanical seal possesses good heat transfer performance and sealing ability.

关键词 spiral groove mechanical seal heat transfer optimum design bearing force leakage rate

分类号

DOI:

An improved design of spiral groove mechanical seal

ZHOU Jianfeng, GU Boqin, CHEN Ye

Fluid Sealing and Control Laboratory, College of Mechanical and Power Engineering, Nanjing
University of Tech-nology, Nanjing 210009, China

Received Revised Online Accepted

Abstract The coupling effect among the flow of fluid film, the frictional heat of fluid film and the thermal deformation of sealing rings is inherent in mechanical seals. The frictional heat transfer analysis was carried out to optimize the geometrical parameters of the sealing rings, such as the length, the inner radius and the outer radius. The geometrical parameters of spiral grooves, such as the spiral angle, the end radius, the groove depth, the ratio of the groove width to the weir width and the number of the grooves, were optimized by regarding the maximum bearing force of fluid film as the optimization objective with the coupling effect considered. The depth of spiral groove was designed to gradually increase from the end radius of spiral groove to the outer radius of end face in order to de-crease the weakening effect of thermal deformation on the hydrodynamic effect of spiral grooves. The end faces of sealing rings were machined to form a divergent gap at inner radius, and a parallel gap will form to reduce the leakage rate when the thermal deformation takes place. The improved spiral groove mechanical seal possesses good heat transfer performance and sealing ability.

Key words spiral groove; mechanical seal; heat transfer; optimum design; bearing force; leakage rate

通讯作者:
周剑锋 zhoujianfeng_ren@163.com
作者个人主页: 周剑锋; 顾伯勤; 陈晔