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轴承腔油气两相流数值模拟的试验验证

Experimental verification of numerical simulation of oil-air two-phase flow in bearing chamber

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作者	单位
汪友勇	南京航空航天大学 能源与动力学院,南京 210016
王锁芳	南京航空航天大学 能源与动力学院,南京 210016
艾俊峰	南京航空航天大学 能源与动力学院,南京 210016
李斌	南京航空航天大学 能源与动力学院,南京 210016

中文摘要:

为探索一种适于模拟轴承腔油气两相流流动特性的数值计算模型,建立了一套简化结构的轴承腔试验装置,通过试验研究获得了不同工况对轴承腔通风口出气比例和回油口滑油温升的影响规律.应用Fluent软件,采用Mixture多相流模型和Eulerian多相流模型分别搭配标准k-ε湍流模型和RNG(renormalization group) k-ε湍流模型对选定试验工况进行数值模拟.对比结果表明:当转速为2200r/min时,使用Mixture多相流模型搭配RNG k-ε湍流模型计算的滑油温升与试验值的相对误差仅为2.72%,体现了该计算模型在高转速时的精确性,并在此基础上获得了油气两相流速度场、压力场和温度场的分布特征.

英文摘要:

In order to search a reasonable numerical model to simulate the flowing characteristic of the oil-air two-phase flow in a bearing chamber, a simplified test rig was set up. Various rules of air flow proportion at the vent and oil temperature rise at the scavenger under different operating conditions were obtained through this experimental investigation. Based on Mixture multiphase model and Eulerian multiphase model with standard k-ε turbulence model and RNG (renormalization group) k-ε turbulence model respectively, the universal computational fluid dynamics software Fluent was used to simulate the two-phase flow in a bearing chamber under some given operating conditions. The comparison shows that the relative error of oil temperature rise between the test result and the computational result under Mixture multiphase model with RNG k-ε turbulence model is only 2.72 percent when rotate speed is 2200r/min. Therefore, this computational model is accurate at high speed, based on which the distribution characteristics of oil-air two-phase flow velocity field, pressure field and temperature field are acquired.