عنوان مقاله:

Cross-Scale Flow Field Analysis of Sealing Chamber and End Face Considering the CO۲ Real Gas Effect

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خلاصه مقاله:

The dry gas seal (DGS) is a non-contacting, gas-lubricated mechanical face seal commonly used in rotating machinery. Traditional analyses of DGSs treat the end face as an independent factor by setting the end-face inlet as boundary conditions, but limited attention is focused on the sealing chamber of the DGS. Using the finite volume method and the shear stress transport (SST) k-ω model, the coupling between the millimeter-scale sealing chamber and the micrometer-scale end face are simulated with regard to the real gas effect of CO۲. The three-dimensional distributions of velocity, pressure and temperature in the cross-scale flow field are investigated under different working conditions. Moreover, the boundary parameters of the end-face inlet are modified by response surface methodology with a central composite rotatable design. The results demonstrate that the real gas effect of CO۲ leads to an increased total inlet flow. When the pressure reaches ۱۰.۳ MPa, the relative difference is ۵۱.۹۰% compared to ideal gas. Minor temperature and pressure changes occur in the sealing chamber when the dry gas seal is in operation. However, the inlet temperature of the end face Tf increases and the inlet pressure of the end face pf decreases. These research results provide a reliable reference for engineering practice.

کلمات کلیدی:

Dry gas seal, Real gas effect, Sealing chamber, Numerical research, Response surface methodology