

表面与界面工程

## 机械密封摩擦副端面接触分形模

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摘要

依据分形理论,研究了机械密封摩擦副端面间的真实接触状况,建立了机械密封摩擦副端面接触分形模型。得到了机械密封摩擦副端面微接触点的面积分布、临界弹性变形微接触面积、临界塑性变形微接触面积、量纲1真实接触面积的数学表达式。采用数值计算方法得到了GY70型机械密封摩擦副端面间的量纲1真实接触面积与端面比载荷的关系曲线。结果表明,真实接触面积随着密封端面比载荷的增加而近似呈线性增加;在相同比载荷下,真实接触面积随着特征尺度系数的增大而减小,随着分形维数的增大而增大,但当D达到167以后,随着D的增大而减小。机械密封摩擦副端面接触分形模型的建立,为研究机械密封摩擦副端面间的摩擦磨损性能和密封性能提供了依据。

关键词

[机械密封](#) [端面](#) [分形模型](#) [接触面积](#) [比载荷](#)

分类号

## Contact fractal model for friction faces of mechanical seals

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### Abstract

The real contact state between the end faces in friction pair of mechanical seals was studied with fractal theory. A fractal model for the end face contact of friction pair was proposed, with which the mathematical expressions for the area distribution of micro-contacting points of the friction pair, the micro-contacting area related to the critical elastic and plastic deformations, and the dimensionless fractional contact area were obtained. A correlation curve describing the relationship between the dimensionless contact area and the unit load on the end faces of GY70 mechanical seal was obtained by numerical calculation. Research results indicated that the real contact area presents an approximately linear increase with surface unit load, and at the same unit load, the real contact area decreases with the increase of characteristic length scale  $G$  and increases with the increase of fractal dimension  $D$ , but decreases with the increase of  $D$  when  $D$  is greater than 167. The end-face contact fractal model for friction pair provides a foundation for the study of the friction mechanism and sealing performance of mechanical seals.

### Key words

[mechanical seal](#) [end face](#) [fractal model](#) [contact area](#) [unit load](#)

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