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电机电工

空气开关电弧的磁流体动力学建模及特性仿真

李兴文[1];陈德桂[1]

西安交通大学电力设备电气绝缘国家重点实验室[1]

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摘要
考虑电弧的物理参数以及电磁、热和辐射等现象，通过对商用计算流体力学软件FLUENT进行二次开发，建立了空气开关电弧等离子体的二维磁流体动力学(MHD)数学模型。然后仿真分析了电弧半径、电场强度与电流之间的关系，以及外部磁场对电弧运动过程的影响。同时完成了相关的实验研究。结果表明随着电流的增大，电弧半径将受到器壁宽度的限制；电流对电场强度的影响很小；外部磁场在加速电弧运动的同时，产生的"磁压"会导致电弧高温区不断被压缩以及局部压力的升高。

关键词 电弧 磁流体动力学 仿真 磁场 电场强度

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Magnetohydrodynamics Modeling and Characteristics Simulation of Air Switching Arc

Abstract
Taken into account the properties of arc plasma and electromagnetic, heat and radiative phenomena, commercial computational fluid dynamics software FLUENT has been adapted and extended by self-written routines to develop the 2-D magnetohydrodynamic (MHD) model of air switching arc. Then the relationships between arc radius, strength of electric field and current, and the influence of external magnetic field on arc motion are analyzed in detail. The relative experiments have also been carried out. The results demonstrate that the variation of arc radius is restricted by the width of arc chamber wall with the increase of arc current; The arc current hardly affects the strength of electric field; The arc motion will be accelerated by the external magnetic field and simultaneously the effect of magnetic pressure makes the arc concentrated and local pressure raised in the area of high temperature.

Key words arc magnetohydrodynamics simulation calculation magnetic field strength of electric field

DOI:

通讯作者 李兴文 jds20@mail.xjtu.edu.cn

作者个人主页 李兴文 陈德桂