论文

电容电路短路火花放电特性及其建模研究

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摘要：

利用安全火花试验装置，得出了电容电路的短路放电电压和电流波形，指出电容的短路火花放电过程可分为4个阶段，即介质击穿、火花产生、火花维持和火花熄灭阶段。提出了一款能模拟电容有触点短路放电过程的模型电路。对放电持续时间与电容及其初始电压间的关系进行了实验研究，指出放电持续时间与电容量近似成线性关系，而与初始电压无关。利用最小二乘法得到了放电持续时间与电容量之间的关系表达式。获得了放电过程各阶段的等效电阻，建立了电容电路有触点短路火花放电的数学模型，得出了放电电流和电压表达式。实例及实验结果验证了所提出模型及理论分析的正确性和可行性。

关键词： 简单电容电路；短路放电；仿真电路；数学模型

Short circuit discharge characteristics of the capacitive circuit and its mathematical model

Abstract:

The short circuit discharge (SCD) characteristics of the capacitive circuit were analyzed，based on the safety spark test apparatus.It was pointed out that the spark discharge process of the capacitive circuit could be divided into four stages，that is，dielectric breakdown stage，spark generated stage，spark maintenance stage and spark extinguish stage.A model circuit was proposed to simulate the SCD process of the capacitive circuit.The relationship between the discharging duration and the capacitance as well as the initial capacitor voltage was studied through the experiments，it was pointed out that the discharging durations becomes longer with the increase of the capacitance，but it isn't related to the initial capacitor voltage.The relationship expressions between the discharging duration and the capacitance in each time stage were deduced with the least squares method.On the basis of deducing the equivalent resistances in each time stage，the analytical expressions of the current and voltage of the SCD were obtained，and the mathematical models simulating the SCD process of the capacitive circuit were proposed.Experiments proved the correctness and feasibility of the model.

Keywords: simple capacitance circuit；short circuit discharge；simulating circuit；mathematical model

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