



Contribution ID: 127

Type: **Oral Presentation**

Design and Test of the Trigger Vacuum Switch and its Trigger Source for the Oil Well Stimulation Device

Wednesday 6 July 2016 17:15 (15 minutes)

In order to meet the stability and high temperature working environment (above 120 degrees) requirement of discharge switch in oil well pulse discharge stimulation device, a kind of Vacuum Switch Triggered (TVS) is developed. Compared with the self breakdown switch, TVS can greatly improve the working life and stability of the whole device. The TVS is designed with multi-rod system to improve the peak current capacity and with suitable main electrode to improve the DC withstand voltage at the same time. The size of the TVS is designed and the uniformity of the electric field is studied by simulation. On the basis of the simulation, suitable main electrode chamfer is designed. Performance parameters for the designed TVS reach working voltage of 25kV, the peak current capacity of 30 kA/100 μ s, the outer diameter of 68mm. Through the experiment study the triggering characteristics, the DC withstand voltage level and the life time of the TVS. After 1000 life time experiments, its triggering characteristics and DC withstand voltage level is still good. The experimental results show that the TVS fully meets the requirements of the Oil Well Stimulation Device. Aimed at the high temperature working environment of the TVS, the trigger source is studied. In that the common thyristor and diode working under high temperature is not reliable, a trigger scheme with a three electrode spark gap instead of thyristor controlling the trigger of the TVS is designed. The trigger capacitance charges from the main circuit charging capacitance, which can simplify the circuit and has no potential isolation problem. After the simulation study and experimental test for the trigger scheme, the results show that the scheme is feasible.

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Session Classification: Oral 3

Track Classification: Power Electronics and High Voltage