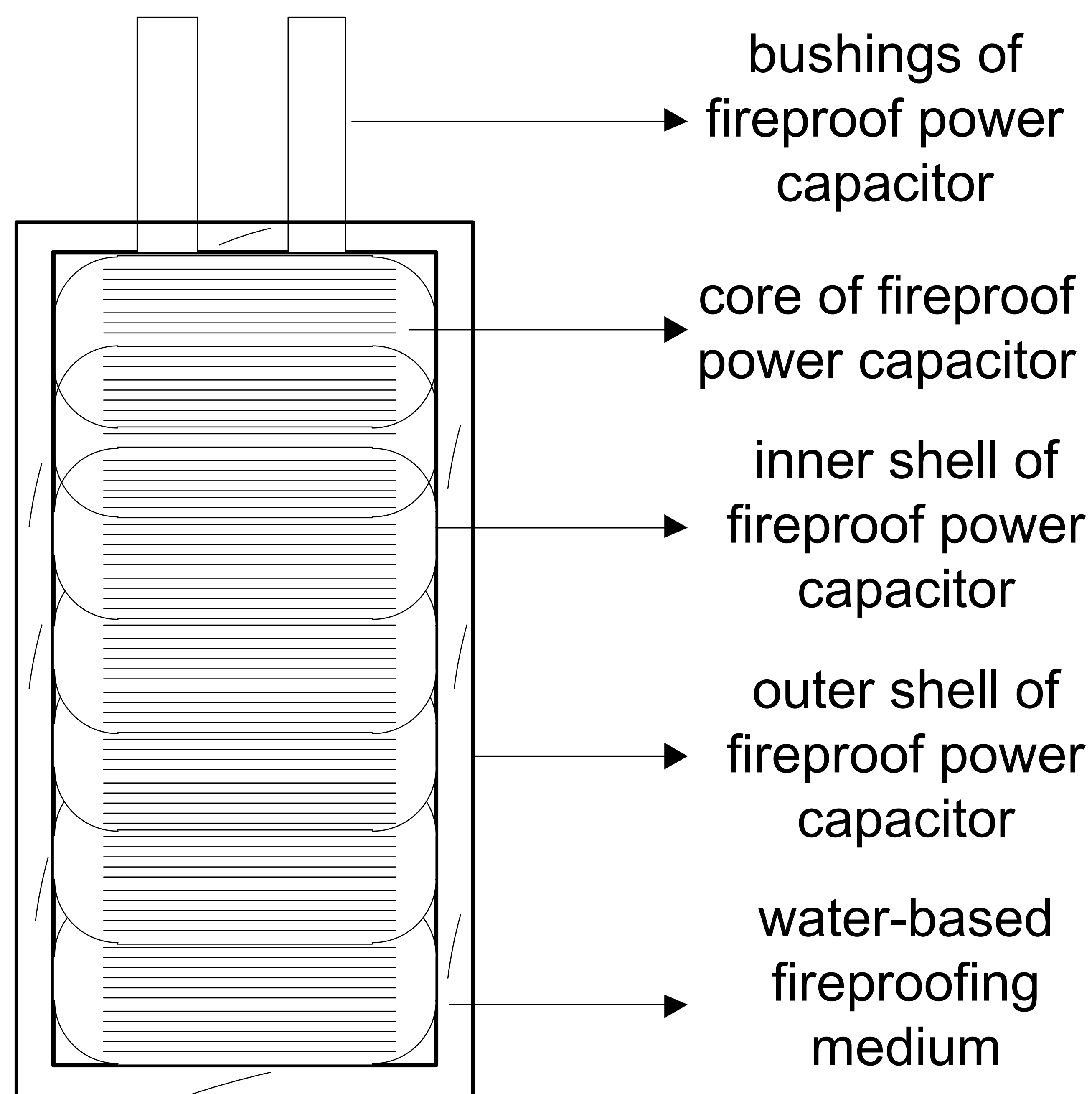


186-Research on Thermal Balance Modeling and Test Analysis of Fireproof Power Capacitor

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1 Introduction

Fireproof power capacitor is based on a complete conventional shunt capacitor with an additional layer of shell, and the water-based fireproof medium is filled between the inner and outer shells, so as to meet the fireproof requirements of power capacitors. As a new type of power capacitor, it is very necessary to carry out modeling research and test analysis on thermal balance of fireproof power capacitor.



2 Analysis of thermal stability test

Type of the samples	temperature rise, K		
	Core temperature t_x	Outer shell temperature t_w	$t_x - t_w$
	Fireproof power capacitor	14.8	4.2
Conventional shunt capacitor	13.1	8.0	5.1
The difference between the two capacitors	+1.7	-3.8	+5.5

The temperature rise difference between the core temperature and the outer shell temperature of fireproof power capacitor is more than twice that of the conventional shunt capacitor, which just proves that the heat conduction process of the fireproof power capacitor is weaker than that of the conventional shunt capacitor.

3 Model calculation and validation

Results	Core temperature $t_x, ^\circ\text{C}$	Outer shell temperature $t_w, ^\circ\text{C}$	inner shell temperature $t_N, ^\circ\text{C}$
Model calculation value	72.7	56.9	67.8
Test value	69.8	59.2	/
The deviation between the two	+2.9	-2.3	/

It can be seen that the deviation between the model calculation value and the test value of the core temperature t_x and the outer shell temperature t_w of the fireproof power capacitor is only less than $\pm 3^\circ\text{C}$, which fully verifies the validity of the thermal balance model of fireproof power capacitor.

4 Conclusion

1) Compared with the conventional shunt capacitor, the heat dissipation area of fireproof power capacitor is increased, resulting in a significant drop in the outer shell temperature. However, due to the weaker heat conduction process, the core temperature rises slightly. The increase of the core temperature will accelerate the thermal aging speed of the dielectric material, resulting in a shorter service life.

2) By comparing the model calculation value with the results of thermal stability test, the validity of the established thermal balance model of fireproof power capacitor is verified.