THE INFLUENCE OF MANUFACTURING TECHNIQUE TO POWER FREQUENCY BREAKDOWN CHARACTERISTICS OF XLPE POWER CABLE

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ABSTRACT

The test methods and evaluating procedures of water tree retardant characteristics have been built. 60 pieces of cable samples with the same structure are made by five factories who use same materials. All samples are divided into four groups for different aging test. Then, all samples are tested to get their AC breakdown voltage. The results show the samples after a short operation have good performance, AC breakdown voltage is close to each other. But after 180 days AWTT, the AC breakdown voltage of samples is different due to manufacturing technique, and the samples from one of the factories do not have water tree retardant characteristic any more.

KEY WORDS

Manufacturing technique, power cable, water tree retardant, accelerated water treeing test (AWTT), AC breakdown, characteristic research

INTRODUCTION

Wire and cable are one of important industries in national economy. It is used widely in all areas in China, and accounting for 25% of the output on electrical equipment industry and 2% of GDP in China. The failure rate of XLPE cable is low in its initial operation, but after operated for more than a decade, the failure rate increases significantly in recent years. Because of the manufacturing process, external factors such as external damage, moisture migration and chemical corrosion, the cable breakdown is due to the growth of the water tree. This kind of case is accounting for over 90% of the total number of power cable failures. Because of lack of understanding of aging process of the insulation and breakdown mechanism, it is impossible to do in-depth theoretical analysis of XLPE cable failure at current research level in China, so this area is still a gap. Therefore, there is an urgent need to do research on how to extend the life and reduce the failure rate of cable [1-5]. Foreign counterparts have done similar research on the relationship between breakdown of cable and a large amount of water tree. In North America and Europe, the breakdown mechanism due to water tree have gradually been carried out and finally accepted by the local power companies, then there is the corresponding cable qualification test specifications [6-8].

This article is based on the effect of the cable manufacturing technique as well as the latest research fruits of the water tree retardand cable.The water tree retardant XLPE insulated power cables are manufactured by five different factories. These cables have the same rated voltage,type and structure, and also have the same trademark conductor screen materials, water tree retardant insulation materials and insulation screen materials. The cables from every factory are cut into 12 pieces, and the length of every piece is 13 m. The all 60 pieces of cable are studied as objects. Every cable sample is manufactured continuously. The distance between two adjacent pieces is 1000 m.

For inspecting the influence of manufacturing technique to power frequency breakdown characteristics of XLPE power cable, the test methods and quality evaluating procedures of water tree retardant characteristics have been built. At the same test condition, according to China's electric power industry standard DL/T 1070—2007 “Qualification test methods and requirements for tree retardant performance of medium voltage XLPE power cable” [9] and Fig.1 “Flow chart of the test”, all the samples are divided into four groups for the aging test with four different levels which are original state, 14 days load cycles state, 120 days AWTT and 180 days AWTT. Then, all of the samples are tested one by one to get their AC breakdown voltage. The breakdown samples are sliced up and coloured to inspect the water tree states, and then all slices are compared and analyzed.

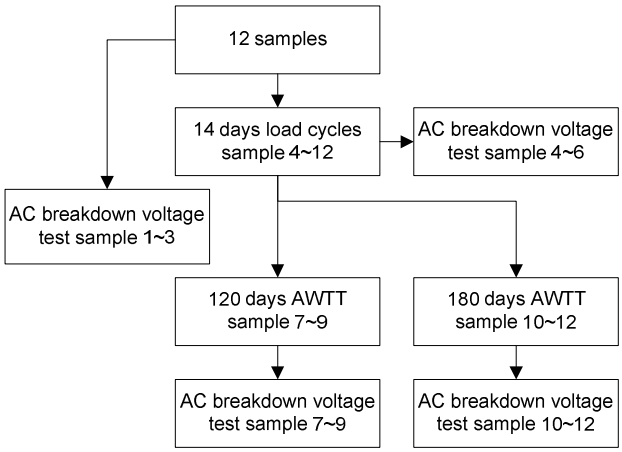

Fig.1 Flow chart of the test

The conclusion of the research is the foundation to spread and apply the new manufacturing technique, new materials and new technologies of tree retardant cable. It is the theoretical basis to design and manufacture insulated power cable, and it is also the theoretical basis to select and use the XLPE power cable for power utility.