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Diagnosis on Winding Failure Through Impulsive Sound of Power Transformer

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The transformer winding will flow a larger impact current in the event of an external short circuit, causing strong vibration, resulting in winding loose and deformation. The loss of short-circuit withstand capability of winding is not a one-time process, but accumulated over the years. As the mechanical condition of winding deteriorates, the safety and stability of transformers are affected. Therefore, it is of great significance to carry out the research on fault diagnosis under short-circuit impact. Different from the vibration signal analysis method using single point or some isolated measuring points which can only reflect local information, the sound signal reflects the overall mechanical condition of the equipment. Short-circuit tests were carried on a 110kV power transformer until the winding impedance changed more than 1%, of which phase A 33 times, phase B 8 times, phase C 16 times. Two microphones were used to record the sound on both sides of bushing outlet so that we can determine which side the fault occurred. According to the characteristics of the sound signal in frequency domain, two fault parameters like odd-even harmonics ratio and sound entropy were proposed. It is found that the entropy increases when the winding loosens, while it decreases when the deformation occurs. The change rate of entropy can reflect the degree of deterioration. The odd-even harmonics ratio significantly increases with a change exceeding 50% in the case of a mechanical failure. According to the proposed fault parameters, a diagnosis on winding failure through the impulsive sound of the transformer is proposed. The impedance measurements and the final results of overhaul validated the accuracy of this new method, what is more, the sensitivity is higher than that of impedance measurements. In addition, this method can carry out on-line testing, while the impedance measurements can only detect offline.

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