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Study on aging characteristics of DC transmission line arrester considering impact load

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Metal oxide arrester (MOA) is the main equipment to limit overvoltage in power system. It has been widely used in UHVDC project in China. The UHVDC system has longer deliver distance. Under the influence of various external factors, the state characteristic parameters of MOA will change and its performance will decline, which is called the aging problem. Unlike the arrester in AC system whose continuous operating voltage is power frequency voltage, the aging of MOA resistors in DC system is more complicated. Based on a $\pm 1100\text{kV}$ UHVDC system in China, this paper studies voltage load waveforms of transmission line arrester in UHVDC system under different operating conditions, and analyzes its amplitude by mathematical methods. Based on simulation results, the impedance characteristics and power consumption characteristics of DC line MOA proportional components under multi-factors were studied. Considering the influence of impact load, the long-term integrated DC aging characteristics of MOA were studied. The comprehensive aging test results show that the DC reference voltage of the mainstream formula has an increasing trend of DC reference voltage after aging, which increases by a maximum of 6.05%; the DC leakage current shows a decreasing trend with a maximum reduction of 76%; the power loss shows a decreasing trend with a maximum of 71.4%. The AC reference voltage shows an increasing trend. The full current, resistive fundamental wave, and third harmonic show a decreasing trend. The capacitance and $\tan\delta$ decrease slightly, and the residual voltage does not change significantly. The influence of different impact loads on DC aging of MOV is square wave>lightning wave>high current. It is found that there is a polarity effect in DC aging, and the regularity of the positive and negative characteristic parameters of MOV is opposite.

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