ABSTRACT

This thesis presents a comprehensive study on the condition assessment and ageing evaluation of dry-type insulation systems using advanced diagnostic techniques. **Chapter 1** presents a comprehensive literature review that outlines the current state of research on dry-type insulation diagnostics, highlighting existing methods for condition and ageing assessment and identifying key gaps that the present work aims to address. In **Chapter 2**, a data acquisition system was developed for the accurate measurement of Polarization and Depolarization Current (PDC) in dry-type insulation. The measured PDC serves as a critical diagnostic signal for assessing the insulation's condition. **Chapter 3** introduces an advanced methodology to estimate the charge trapping characteristics within the insulation based on the PDC measurements. These parameters provide valuable insight into both the condition and the quality of the dry-type insulation. In **Chapter 4**, an advanced technique is proposed for estimating the ageing state of the insulation by analyzing relaxation characteristics derived from frequency domain spectroscopy, particularly through the electric modulus representation. This approach effectively mitigates the influence of electrode polarization, thereby enhancing the visibility of relevant relaxation processes. Finally, **Chapter 5** presents the development of an advanced methodology for estimating the ageing state of dry-type insulation based on relaxation frequency distribution. This method offers improved accuracy in predicting ageing status and supports more reliable condition assessment as well as asset management decisions. Overall, the methodologies presented in this work contribute significantly to the non-destructive evaluation of dry-type insulation systems.