Assessment diagnostics of the functionality of composite insulators operating in the 150kV power network of Crete

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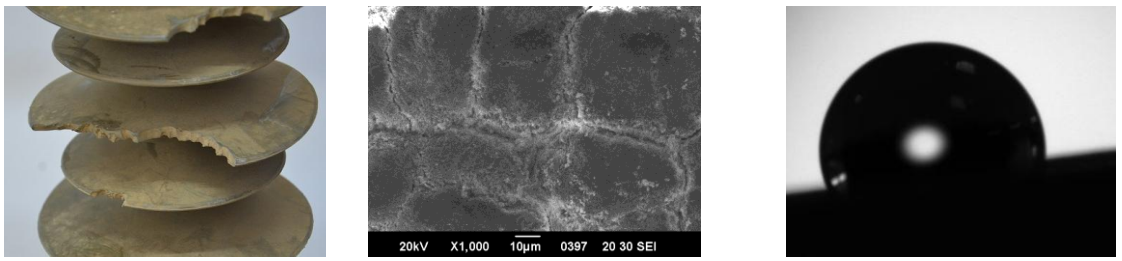
The performance of high voltage insulators utilized in overhead transmission and distribution lines is a key factor for the reliability of power delivery. Ceramic insulators are replaced by composite insulators, made nowadays by Silicone Rubber with the later providing considerably improved pollution performance in comparison to the ceramic counterparts. The feature that enables composite insulators to perform better than ceramic is their surface behaviour, which is hydrophobic and thus suspends the possibility of surface wetting by dew or fog, which is recognized as a phenomenon critical component. Furthermore in the case of silicone rubber, a more advanced hydrophobicity performance has been developed, capable of recovering the surface behaviour even if hydrophilic contaminants are deposited on the material surface. However, surface hydrophobicity, as a material oriented property, is strongly affected by the ageing mechanisms present in service conditions [1]. Actually, the efficiency of the recovery feature, experienced in the case of SIR is related to the housing material condition and the existing stress conditions. In order to reduce the failure probability, combined diagnostic techniques are required for the assessment of the functionality of composite insulators [2], their results being essential in deciding the maintenance or the replacement of the installed material.

In Crete, more than 50% of the currently installed insulators are made of SIR. In addition, a considerable amount of room temperature vulcanized SIR coatings has been implemented in high voltage substations. In both applications, an average service period of 16 years has been experienced and no flashovers or other insulator failures in the have been recorded. Nevertheless, despite this encouraging fact, according to the international literature and the experience of other utilities, exceeding the age of 15 years in service must be a concern. In this direction the operational condition of composite insulators is under investigation, aiming to evaluate their efficiency and the level of stress that the ageing mechanisms present have applied. In this study, an inspection procedure is presented and analyzed, implemented to field aged composite insulators of the 150kV power network of Crete, incorporating electrical, structural and morphological characterization (Fig. 1) is employed in order to evaluate the condition of field composite insulators of the 150kV power network of Crete.



(a) Field Inspection – Bird Attack in a field composite insulator. (b) SEM image of a degraded field composite insulator (c) Evaluation of field insulator hydrophoic performance.

Figure 1: Diagnostic Techniques for evaluating the condition of field composite insulators

References

[1] IEEE Guide for Ageing Mechanisms and Diagnostic Procedures in Evaluating Electrical Insulation Systems, ANSI/IEEE Std 943 1986.

[2] CIGRE Technical Brochure No 545, Assessment of in-service Composite Insulators by using Diagnostic Tools, WG B2.21, 2013.

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