What gaps still exist in standards which need to be addressed to improve ultimately in-service performance?

The paper 10828 presents and evaluates different test methods and their acceptance criteria in order to validate the quality of composite line insulators. Especially tests evaluating the materials and the interface core/housing are in focus since "flashunder" due to poor adhesion between housing and core has been revealed to be the dominant cause for failures worsened by exceeding the recommended limit of the axial electric field.

Since the paper refers to some gaps in the standards, a question from a reviewer is what gaps still exist in standards which need to be addressed to improve ultimately in-service performance? This is an important question since there are still some gaps related to composite insulators, especially for DC.

One gap in standards refers to tests in order to ensure a good adhesion between housing and core. Several investigations have revealed that the root cause of failures in service is a weak adhesion between housing and core; leading to “flashunders”. It was found out that the IEC steep-front test intended to verify the integrity of interfaces of composite insulators could not reveal artificially caused bad adhesion. Some investigations regarding this issue have been done already, some are still ongoing. [1][2][3] Furthermore, tests to evaluate the quality of different sealing methods at the triple point between air, housing, and metal end fitting of composite line insulators are missing in standards. There are some tests for interfaces and connections, but none of these focus especially on the triple point. A poor quality sealing could lead to air bubbles in the sealing or a low adhesion between the sealing and other insulator components. This can result in moisture penetration followed by corrosion which could even be accelerated by possible discharge activity leading to an insulator failure. [4]
Another issue is the tracking and erosion test for insulators intended to use for DC. It is known that the test method for AC cannot be transferred to insulators for DC without any modifications. One problem is the high dispersion of results while using this test method for DC. Investigations to this topic are ongoing by the Cigré working group D1.72.
In general terms, for both ceramic and composite insulators the methodologies for more advanced pollution measurements are also missing as well as more experiences with DC pollution monitoring including hydrophobicity loss, transfer and recovery. Presently valid IEC standards for the selection of insulation for polluted areas recommend only standard ESDD/NSDD and standard DDDG measurements.

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[2] Jaka Strumbelj, Christiane Baer, Jan Lachman, Frank Schmuck: “Application of Multi-stress Test Methods to evaluate Today`s Composite Insulator Reliability”, Cigre Session 2022.
[3] J.Strumbelj, C.Baer, J.Lachman, F.Schmuck, E.Tinner, S.Kornhuber: “Technical Demands to Improve Today`s Composite Insulator Reliability”, Cigre Session 2020.
[4] K. Varli, S. Steevens, J. Unterfinger, A. Dernfalk, I. Gutman, J. Lundengård, P. Sidenvall: “Benchmarking of sealing systems of composite insulators: ideas for innovative test methods”, Cigré Science & Engineering, June 2022