



INTISARI

Isolator keramik merupakan salah satu komponen utama dalam sistem transmisi tegangan tinggi, yang berfungsi untuk mendukung konduktor secara mekanis sekaligus memberikan isolasi listrik. Namun, isolator dapat mengalami penuaan (*ageing*) akibat paparan berbagai faktor lingkungan seperti radiasi UV, polusi, dan kelembapan, yang dapat mengurangi keandalannya dan meningkatkan risiko terjadinya *flashover*. Penelitian ini bertujuan untuk mengkaji pengaruh UV terhadap *flashover*, arus bocor, dan sudut kontak pada isolator keramik yang telah mengalami proses penuaan dalam kondisi terlapis *nano ceramic coating*. Isolator keramik diuji menggunakan metode akselerasi penuaan berbasis paparan radiasi UV dengan dua tingkat intensitas, yaitu rendah ($2,17 \text{ mW/cm}^2$) dan tinggi ($6,10 \text{ mW/cm}^2$). Setelah proses penuaan, nilai tegangan *flashover*, arus bocor, dan sudut kontak isolator diukur dan dianalisis. Hasil penelitian menunjukkan bahwa tegangan *flashover* di bawah paparan UV intensitas rendah, dengan penurunan hanya 0,73 kV (0,87%) setelah 120 jam dan laju degradasi minimal 0,0068 kV/jam. Namun, menurun signifikan pada UV intensitas tinggi, ditunjukkan oleh penurunan tegangan *flashover* 2,21 kV (2,65%) dan laju degradasi $3 \times$ lebih cepat. Arus bocor meningkat pada UV tinggi, terutama di tegangan rendah (5 kV) dengan kenaikan dari 110,30 μA menjadi 221,20 μA . Selain itu, terdapat korelasi negatif sangat kuat ($r_s = -0,991$) antara tegangan *flashover* dan arus bocor. Pengujian juga menunjukkan bahwa sudut kontak mengalami penurunan, di mana paparan UV rendah menurunkan hidrofobisitas dari $84,425^\circ$ ke $71,824^\circ$ dan paparan UV tinggi mengubah sifat hidrofobik menjadi hidrofilik ($45,084^\circ$). Penelitian ini menunjukkan bahwa penerapan *nano ceramic coating* dapat memperlambat degradasi permukaan isolator keramik dan mengurangi risiko *flashover* serta arus bocor, terutama pada kondisi radiasi UV rendah. Temuan ini diharapkan dapat menjadi referensi untuk strategi perawatan isolator dalam meningkatkan keandalan sistem transmisi listrik, terutama di lingkungan tropis yang memiliki tingkat radiasi UV tinggi.

Kata kunci: isolator keramik, penuaan radiasi UV, lingkungan tropis, pengujian *flashover*, pengujian arus bocor, pengujian sudut kontak



ABSTRACT

Ceramic insulators are one of the main components in high-voltage transmission systems, functioning to mechanically support conductors while providing electrical insulation. However, insulators can undergo ageing due to exposure to various environmental factors such as UV radiation, pollution, and humidity, which can reduce their reliability and increase the risk of flashover. This study aims to investigate the effect of UV on flashover, leakage current, and contact angle in ceramic insulators that have undergone an ageing process while coated with nano ceramic coating. Ceramic insulators were tested using an accelerated ageing method based on UV radiation exposure at two intensity levels: low (2.17 mW/cm^2) and high (6.10 mW/cm^2). After the ageing process, the flashover voltage, leakage current, and contact angle of the insulator were measured and analyzed. The results showed that the flashover voltage under low-intensity UV exposure decreased by only 0.73 kV (0.87%) after 120 hours with a minimal degradation rate of 0.0068 kV/hour . However, a significant decrease was observed under high-intensity UV, with a flashover voltage drop of 2.21 kV (2.65%) and a degradation rate three times faster. Leakage current increased under high UV, especially at low voltage (5 kV), rising from $110.30 \mu\text{A}$ to $221.20 \mu\text{A}$. In addition, there was a very strong negative correlation ($r_s = -0.991$) between flashover voltage and leakage current. The tests also showed a decrease in contact angle, where low UV exposure reduced hydrophobicity from 84.425° to 71.824° , and high UV exposure changed the hydrophobic nature to hydrophilic (45.084°). These findings are expected to serve as a reference for insulator maintenance strategies to improve the reliability of power transmission systems, especially in tropical environments with high UV radiation levels.

Keywords: ceramic insulator, UV radiation ageing, tropical environment, flashover testing, leakage current testing, contact angle testing