

# Investigation of Static Voltage Accumulation on Wind Turbine Blade in Atmospheric Wind speed Humidity and Temperature

[Badanie akumulacji napięcia statycznego na łopatach turbiny wiatrowej przy prędkości wiatru atmosferycznego, wilgotności i temperaturze]

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## ABSTRACT

Wind turbines are one of renewable energy sources. Wind turbines installed at wild open area such offshore, mountains and deserts are filled with air particles and flow of wind speed. During the wind flow throughout the wind turbines which rotates the turbine blades, there is friction between the air particles and the blade surface that leads the static voltage to accumulate on the blade surface causing upward streamers. Using fiberglass reinforced plastic (FRP) wind turbine blades by simulation and experimental method. The charged particle tracing with electrostatics and laminar flow with time-dependent used to determine the value of static voltage accumulation. Static voltage accumulation is influenced by various factors such as wind speed (1, 5, and 7 m/s), humidity (20, 50, and 70 %RH) and temperature (28, 35, and 48 oC) had tested and analyzed. Furthermore, the result obtained using the Finite Element Method (FEM) has shown a good agreement with the experimental result. It was observed that high flow velocity has a great tendency to charge the blade surface with 36.70% higher from 1 m/s to 7 m/s. Low relative air humidity increases the risk of static electricity 221.6 V at the of side of the blade when humidity is 20%. Moreover, increasing the air temperature from 28 to 48 degrees Celsius increases the voltage by 20%. Therefore, determining the need for static voltages generated in the blade surface and the risk related to upward streamers is obliged to be evaluated as it is the essential ways in adopting the correct protection systems.

## KEYWORDS

CFD; Electrical field; lightning Protection; Static Voltage Accumulation

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