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The Potential of Coating Layers on Erosion Resistance of Wind Turbine Blades

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In this study, experiments are conducted to study the erosion behavior of various coatings on glass-fiber reinforced epoxy polymer composite (GFRP) substrate by silica sand particlesfor applications of wind turbine blades. The effects on erosion rate of impingement angle (0°-90°), erodent velocity (20-80 m/s), coating types (2K acrylic-base, polyurethane-base, polyurea-base) and coating thicknesses (120-2000 μm), erodent size (300 μm) are investigated. Additionally, the results were statistically analysed using ANOVA and plotted using response surface methodology (RSM) to obtain in-depth understanding of significant factors affecting erosion. Moreover, predictive regression models were generated in the form of equations and contour plots to estimate erosion responses at various factor combinations. Results show that elastomeric coating application on GFRP substrate can lead to reduction in erosion rate of up to more than 96% compared to uncoated GFRP. However, at other parameter combinations, an increase in erosion rate of about 4.5% due to coating is noted. Additionally, the application of coating on GFRP at certain parameter combination leads to change in erosion peak behavior from lower angles of 30° to around 45°. This constitutes a transition of erosion mechanism from ductile to semi-ductile behavior. This transition may be attributed to the coating formulation as well as testing conditions. In fact, at other parameter combinations, erosion behavior of coated samples remains unchanged compared to uncoated GFRP.

Biography:

Professor Nabil El-Tayeb gained his PhD from Leeds University in Leeds, UK (1986), attended his MSc at Aston University in Birmingham, UK (1982), and received his first degree “BSc” distinction with honor from Helwan University-Cairo (1977). He has over 170 international and National Publications: 85 Research Publications in the International journals of: Wear, Tribology International, Proc. IMechE Part J: J. Engineering Tribology, Materials Processing Technology, Materials & Design, Tribology online, Tribology Letter, International Polymer Processing, Tribology Transaction, Applied Composite Materials, Lubrication Science, Machining Science and Technology, Applied sciences, American Journal of Applied Sciences, Surface Review and Letters.