

New progress in self-healing technology of composite wind turbine blades

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Wind turbine blades are subjected to external cyclic loadings, resulting in the development of micro and nanocracks, which in course of time becomes macro cracks, thus leading to fatigue and failure. The concept of self-healing composite materials might be introduced into the blade manufacturing to reduce the cost and to increase the life expectancy of the turbine blades. This can be performed by introducing urea-formaldehyde (UF) micro capsules into the epoxy matrix of the composite materials. The urea-formaldehyde microcapsules are filled with dicyclopentadiene (DCPD) which acts as the healing agent. When DCPD is introduced into the crack of the epoxy matrix, it reacts with a catalyst in the matrix and heals the cracks. The dispersion of nanoscale inclusions in the epoxy matrix has the potential of increasing the mechanical properties of the polymer composite in a great deal. When the nanoscale inclusions are used as reinforcements in the composite material, the rate of crack growth could be considerably reduced. This work deals with the self-healing of the wind turbine rotor blades. We used different nanoscale inclusions in the microspheres of DCPD to increase the healed fracture toughness and avoid crack regrowth. Wind farms in Kansas are producing 1228 MW of energy and the new wind farms being constructed would produce 921 MW of energy making it one of the biggest industries in the region. This research potentially increases the service life of the composite wind blades and reduces the overall costs. This concept can also be used for the repair of wind turbine rotor blades which helps creating many new jobs in this sector.