WindSTAR
Wind-Energy Science, Technology, and Research
Industry/University Cooperative Research Center

Effects of Manufacturing Induced Defects

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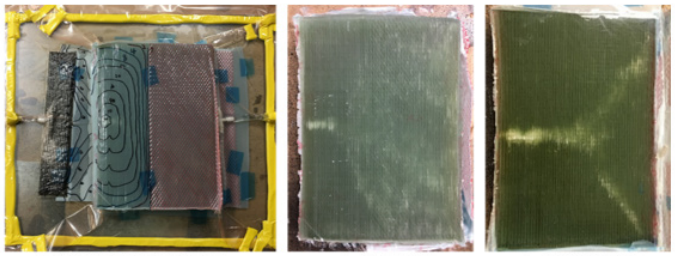
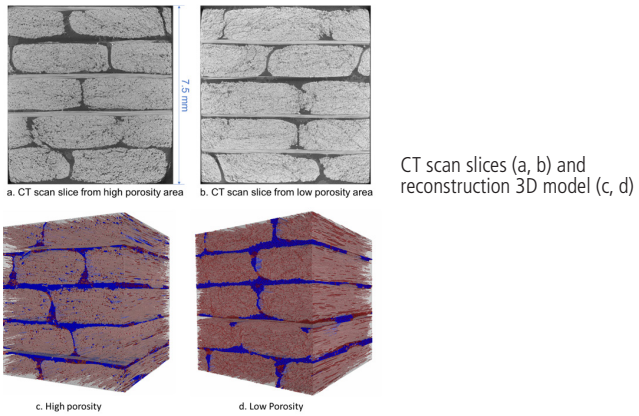
Manufacturing-induced defects such as local regions of porosity are commonly formed during the resin-infusion step of composite wind blade manufacture, and this porosity is a consequence of air trapped during resin mixing or by nucleation from volatiles. These local regions of porosity can have an adverse impact on the resulting fatigue life of the blade. Due to the absence of any theoretical or empirical models to predict how these local regions of porosity will decrease the nominal fatigue life of a composite wind blade in service, the wind industry is forced to make subjective decisions on the disposition of composite wind turbine blades with regions of high porosity. The current research sought to fill this need for an empirical model to relate state of porosity to the associated fatigue life. A methodology for making composite plates with the various degrees of porosity that can result from the wind blade manufacturing process was developed. These plates were subsequently cut into flexure, compression and fatigue specimens using a water jet saw for large cuts and a wet saw for small cuts. The degree of porosity was investigated using three optical techniques, i.e. optical microscopy, SEM (scanning electron microscope), and micro-CT scanning. Future work in this research will include fatigue testing and the subsequent development of the empirical model(s). These model(s) will enable improved decision making on blade disposition, OEMs and wind farm operators to potentially negotiate reduced price based on the state of porosity, and insurers to tailor the insurance premium to the state of porosity.



Photographs of Sample #4



CT scan slices (a, b) and reconstruction 3D model (c, d)

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