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Multiple scale study of hydrothermal degradation in the interfacial regions of flax fiber/bio-based polyurethane composites

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The recent years has witnessed a rising development of bio-composites in a wide range of applications. Much effort has been devoted to improve the performance of bio-composites. One of the most important aspect lies in the optimization of the interfacial properties. The intrinsic hydrophilic properties of natural fibers not only cause incompatibility with matrix but also make the interfacial regions very sensitive to weathering effects. The changing ambient temperature, humidity might cause degradation in the interfacial regions in the long term, which is among the least understood components of bio-composites. This study aim at a better understanding of hydrothermal degradation and its effects on the interfacial properties of flax fiber/bio-based polyurethane composites. Experiments were elaborated at two scales. Single yarn fragmentation tests were performed as a reliable way to focus on the fiber/matrix interfaces. Corresponding unidirectional tensile tests were performed to investigate the influences of degradation at the scale of composites. It is found that interfacial bonding between flax fibers and matrix were weakened by the degradation caused by the hydrothermal effects. Results obtained at two scales correlate with each other well. Degradation in the interfacial regions can be well reflected by indicators from single yarn fragmentation tests like fragmentation development, fragmentation length distributions, and crack shapes etc. Interestingly, not only water absorption, but also water desorption cause degradation of fiber/matrix interfaces.

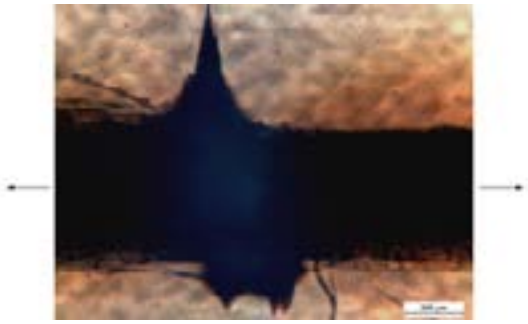

Figure 1: Cracks in the yarn/matrix interfacial regions under tensile loads in yarn direction

Biography

Yunlong Jia is a doctoral candidate in Hamburg University of Technology with his research topic 'durability of flax fiber reinforced bio-composites for structural applications'. He graduated with M.Sc. in mechanical engineering in 2012 and published four articles during his graduate program. After graduation, he was finically supported by the China Scholarship Council to conduct his research in the Institute of Polymer Composites.

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