High performance polyetherimide composites

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For a multitude of applications, especially in the aerospace sector, it is very important that composite materials do not only poses superior mechanical properties but also perform at high service temperatures. [1,2] High-performance thermoplastics such as poly(ether ether ketone) (PEEK), poly(ether sulfone) (PES), and poly(phenylene sulfide) (PPS) have been extensively explored for this purpose.[2,3] Among these, polyetherimide (PEI) emerges as a promising matrix due to its high glass transition temperature (T_g) of ~ 220 °C at relatively lower cost compared to PEEK and PES.[3] PEI retains excellent mechanical properties up to 200 °C, making it a strong candidate for advanced composite applications. However, producing high T_g polymer composites remains challenging.[2]

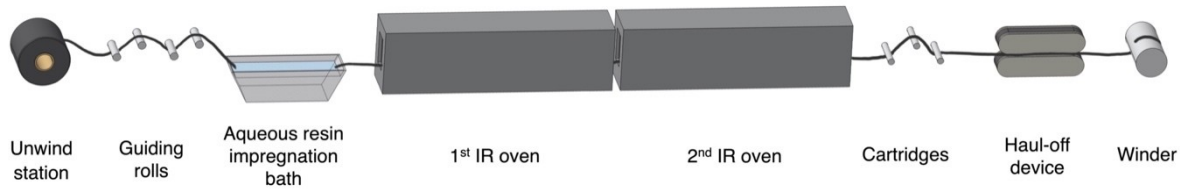

Figure *1*. Schematic of powder impregnation composite production line.

In this study, we present a simple and efficient method for fabricating carbon fibre-reinforced PEI tapes and laminates with a fibre volume fraction of 58 % using a purpose-built composite production line. HexTow® AS4D (12K) carbon fibres were impregnated with PEI through an aqueous resin bath. The wet impregnated tow was passed through two infrared (IR) ovens to remove the water and guided to a set of 3 heated shear pins operated at 350 °C with the purpose of melting the polymer. The thermoplastic prepreg was then consolidated in a hot press. Optical microscopy confirmed uniform fibre impregnation with minimal void content (1.4 – 2 %). Mechanical testing demonstrated strong interfacial adhesion and high compressive properties even at 90 °C.

Keywords: polyetherimide, high-performance polymers, carbon fibre-reinforced polymer composites

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