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Mini Review

Fourier Transform Infrared (FT-IR) Spectra Characterization of Recycled Carbon Fiber Composites: Mini Review

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Abstract

Post-industrial off-cuts of carbon fiber epoxy and carbon fiber vinyl ester composites recycled mechanically and characterized by Fourier transform infrared (FT-IR) to obtain an infrared spectrum of absorption or emission of the untreated and heat-treated recycled carbon fiber composites. FT-IR spectra were recorded with a Bomem MB series FT-IR spectrophotometer.

FTIR Characterization

The use of carbon fiber composites (CFCs) is dramatically increasing due to their higher fatigue life, better corrosion and fire resistance, and more flexible design options over conventional materials. The process from manufacturing carbon fiber to production of finished components is wasteful; it is estimated that more than 30% of produced carbon fiber ends up as waste at some point in the process. Unlike their metal counterparts, wastes produced during synthetic-fiber composites (SFCs) manufacturing and assembly, along with end-of-life products, have limited options for reuse [1-3]. Options to incinerate or disposal has negative environmental contributions and disregards the potential recycled CFCs have as a feedstock for second generation products. There is a potential to recycle the carbon fiber from the thermoset matrix via chemical or thermal treatments, however the resulting fiber is often lower in mechanical properties than virgin fibers and are very difficult to disperse into many matrices due to their crimped and entangled form. Mechanical techniques that employ shredders, hammer-mills, knife-mills, etc. provide a low-cost option to deliver a reliable feedstock. Mechanical recycling is a low-cost and energy-efficient method for CFCs [4-6].

FT-IR spectra of untreated and heat-treated mechanically recycled carbon fiber epoxy and carbon fiber vinyl ester composites (CFC) are shown in Figure 1-4 respectively. The spectra of epoxy-based CFC show a band at 1507cm^{-1}, corresponding to C-H bending and a band at 1734cm^{-1} assigned to the C=O [3-4]. The FT-IR spectrum of vinyl ester-based CFC exhibits a band at 1716cm^{-1} corresponding to the C=O and a band at1540cm^{-1}[7-9].

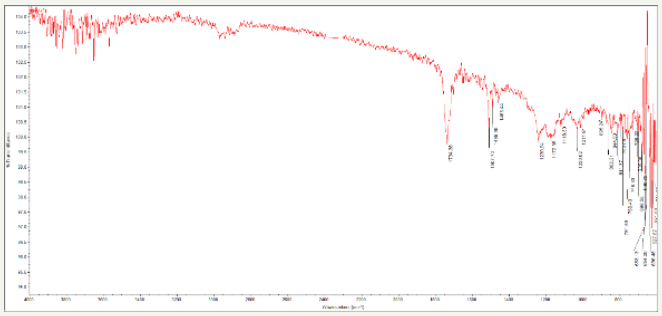

Figure 1: FT-IR spectra of epoxy-based CFC.

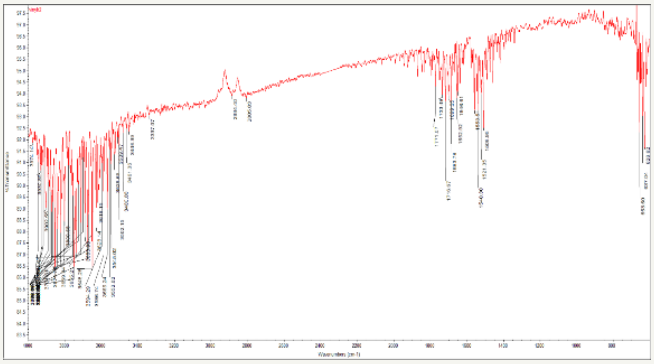

Figure 2: FT-IR spectra of Vinyl ester-based CFC.
Comparing FT-IR of untreated and heat treated rCFC indicates that there is no significant difference between their spectra.

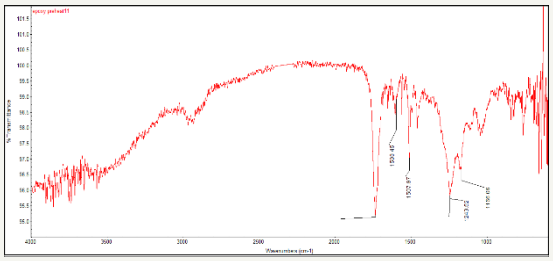

Figure 3: FT-IR spectra of heat-treated epoxy-based CFC.

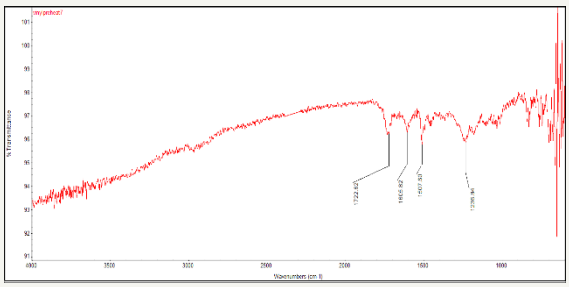

Figure 4: FT-IR spectra of heat-treated Vinyl ester-based CFC.a

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