Future Opportunities and Challenges for 'Green' Materials and Nanocomposites

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ABSTRACT

The materials community has been significantly changed over the last few years by two external factors: the increasing desire for more environmentally friendly materials and processes; and the desire to take advantage of materials engineered at the 'nano' level. This has resulted in new 'green' and 'nano' materials that are available commercially as well as new multifunctional materials that appear to be on the road to commercialization. Structural 'biocomposites' can be made by embedding natural/bio-fibers like Kenaf, Hemp, Flax, Jute, Henequen, Pineapple Leaf Fiber, Corn Stalk fibers and Native grasses into petroleum-derived traditional plastics like polypropylene, unsaturated polyesters, and epoxies as well as by embedding these biofibers into renewable resource-based bioplastics such as Polylactides (PLA), cellulosic plastics, soy-based plastics, bacterial polyesters and urethanes produced from vegetable oil based polyols. Nanocomposites are also opening up 'windows of opportunity' for new applications of polymers to not only structural but also non structural areas by providing ways to tailor surface, electrical, thermal and barrier properties. The choices of nanoreinforcements are growing ranging from carbon nanotubes to nanoclays and cellulose nanowhiskers. Current and new nanoreinforcements will be presented and discussed form a physical property and economics basis.

Both of these developments can have important benefits for the automotive industry in terms of weight reduction, recyclability, and environmentally friendly materials. This paper will provide an overview of both the 'green' and 'nano' materials fields with a focus on automotive needs. The current and future potential of these materials for structural applications will be discussed as well as the challenges that must be overcome in order for them to achieve their potential in automotive applications.