Using carbon fibre reinforced polymer

Science, Chemistry

Using Carbon Fibre Reinforced Polymer

Section 1

Using CFRP (Carbon Fibre Reinforced Polymer) composites for car body structural applications has several advantages over traditional metallic components. First, CFRP technology has tensile strengths higher than traditional metallic materials do. CFRP composites are one of the world's toughest and commercially viable fibres in terms of tension. The rigidity of any component is reliant on its modulus of elasticity. CFRP components have an elasticity modulus of 20 msi, which is relatively equal to a strength of 500 msi, while steel has 10 msi. This property is beneficial to cars bodied with CFRP materials since they can endure an immense amount of energy or force without twisting or stretching (Deng, 2008, p. 2). Second, CFRP technology expand less when exposed to intense or extremely low amounts of thermal energy than traditional metallic materials. Car bodies made of CFRP technology will endure high and low temperature fluctuations without expanding or contracting in contrast to those made of traditional metallic components such as aluminium or steel (Huber, 2010, p. 12).

Third, CFRP technology are light in terms of mass because of their low densities. Unlike steel and aluminium, CFRP composites have extremely high strength to mass ratios. In automobile body structural design, it is paramount that the external architecture is extremely low in energy usage, thereby raising energy efficiency. Vehicles with CFRP composites can reach high speeds within a shorter time while using minimal energy and still maintain a great deal of its shape after an impact unlike those with bodies of traditional metallic components (Huber, 2010, p. 12). Fourth, CFRP technology has excellent durability. Aluminium and steel in vehicle body structures weaken quicker than CFRP technology because of their inferior fatigue features. When the vehicle is under tension of repeated usage, the CFRP body maintains sturdiness and even shape. High durability leads to decreased life cycle expenses for users of CFRP technology (Deng, 2008, p. 2).

Section 2

Dan Carney argues ways anisotropy relates to composite materials and metallic materials, as well as ways to minimize this issue by studying Ferrari. Using CFRP technology in vehicle production is hard in contrast to manufacturing custom race vehicles, very low capacity, and costly automobiles. This difficulty leaves room for aluminium although vehicle designers and manufacturers acknowledge CFRP composites as the perfect blend of strength and mass. Carney uses Ferrari as a case study of the trouble with CFRP technology when compared to traditional metallic materials such as aluminium alloys (Carney, 2011). Ferrari argues that aluminium has a shorter processing time than CFRP composites. Apparently, aluminium can processes around 30 vehicles daily. This capacity prevents the usage of “ time-and-labour intensive” pre-saturated carbon-fibre material in support of a procedure that adds resin to the material following its placement into shape.

The strengthening mechanism employed by Ferrari includes five different composites in the Ferrari 458 model’s extrusions and layers. Heat-treating is the mechanisms that contributes to these alloys’ strengths, along with “ alloy sheets, cast, and extruded aluminum” (Carney, 2011). Strengthening mechanisms at Ferrari require joining methods such as soldering, bolting, fasteners, and epoxy attachments. Numerous joints employ both epoxy attachments and a mechanical rivet or bolt. Ferrari thinks epoxy attachments will be more critical as it progresses towards the ensuing aluminum composite, metal material alloy. Lastly, for Ferrari, achieving low weight with CFRP technology requires new materials that increase the volume of the respective CFRP composites. As a result, the CFRP building methodology is ineffective for accomplishing Ferrari’s mass-saving potential for making viable vehicle body materials.

References

Carney, D 2011, ‘ Ferrari prefers aluminum over carbon fiber,’ Automotive Engineering Magazine, viewed 3 May 2015, http://articles. sae. org/10391/

Deng, J 2008, Durability of Carbon Fiber Reinforced Polymer (CFRP) Repair/strengthening Concrete Beams, Los Angeles, CA: ProQuest.

Huber, M 2010, Quality Assurance of Reinforced Concrete Structures Strengthened by Externally Bonded CFRP Strips, Berlin: diplom. de.