ON CARBON FIBER BICYCLE COMPONENTRY

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Current bicycle materials technology is appropriating from Formula 1 and aerospace and approaching the same narrow safety margins of those fields. So, along with the benefits of ultra-high performance comes the responsibility and necessity of the user to continuously inspect and maintain equipment, just as those other fields demand and require. Of course, in F1 or aerospace the user (driver/pilot) is supported by mechanics and technicians. Most cyclists enjoy no such infrastructure.

In reality, its necessary is for the user to match his/her up-front equipment investment with an appropriate budget for maintenance and repair. This includes both time (education and frequent inspection of components) as well as expense (the cost of engaging a skilled mechanic or the replacement cost of damaged components).

For example, the reliability and cost of maintaining a high-end $100,000 super-car is not the same as a mass produced $25,000 sports car. In the same way, a $6000 bicycle has a different maintenance requirement vs. a $1500 bicycle. It's up to the consumer to consider needs vs. resources and accept the hidden costs of ultra high-performance components.

Twenty years ago, composites were already well established in aviation and sporting goods industries, and current composite bicycle components benefit from a further 20 years development of materials and manufacturing. Most of today's products are "high tech" far beyond of the technology of 20 years ago, although some are even more advanced, benefiting from recent developments in composite materials and design. They demonstrate exceptional strength, durability, and light weight that older technologies can't approach.

At first glance, the material is softer and easier to damage than aluminum. But the outside layer of fibers is often a 3D weave placed exclusively to resist damage (impacts, scratches, etc.). The fibers that do the principal load bearing are safely encased within. So, cosmetic harm to the outside layer is often not as serious as one might assume.

The dark, varied appearance of carbon components doesn't show abuse as easily as aluminum. Sure, a ding is disappointing, but years down the road, carbon components often don't look as beat up as their aluminum counterparts. But as a result, a user can't always easily identify damaged parts that need replacement. Impacts and hairline cracks are hard to spot.

For small, superficial scratches to the surface clear-coat, an easy cosmetic repair is available. Simply clean the mark and brush on clear nail polish. For a nearly undetectable result, orient the chip facing up. Lay a drop of polish in the recess with a toothpick. When it fully dries, lay in another drop. Eventually, the chip is filled up to its original level. Very light polishing with something like Simichrome can make the damage disappear. We recommend not paying so much attention to the finish.

Well designed carbon components can resist mechanical deterioration very effectively. Their complex, layered structure creates many barriers to crack propagation. Certainly, any serious damage recommends replacing the component.

Properly designed carbon components are designed to fail in a controlled manner without catastrophic failure. Damage to the fiber layer warrants, at the least, periodic inspection against crack development.

Carbon fiber components can deliver outstanding fatigue properties. Typically, the fatigue life of carbon components is far superior to that of aluminum alloy components.

Carbon fiber composites are very corrosion resistant, they are essentially reinforced plastics. The specter of galvanic corrosion of adjacent metallic components is controlled through proper design of bonded metal-composite joints; thorough coverage of fiber with resin and non-conductive interfacial barriers of glue and/or glass-fiber and surface clear-coats to electrically insulate the joint prevent galvanic corrosion of neighboring metal components.

In our industry, carbon fiber is far from being fully harnessed. Design is taking huge leaps forward. With metals, the technology is also advancing but at a far slower rate. Conventional metal bicycle parts are nearing their theoretical potential, but fiber composites have still un-tapped potential. Big developments lie ahead.

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