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Preliminary Investigation on the Compatibility of Different Composite Systems With Different Fuels

Luca Calamai
Italy, Independent

Abstract
The octane number is an index of the resistance to detonation of fuels. In particular, a higher octane number indicates a better anti-knock power. Here we wanted to investigate the compatibility of different epoxy formulations, used to make carbon fiber composites, with fuels with different octane numbers.

Keywords: composites, epoxy, carbon, fuel, octane

1. Introduction

An octane rating, or octane number, is a standard measure of a gasoline capability against compression. The higher the octane number, the more compression the fuel can withstand before detonating. Fuels with a higher octane rating are used in higher-compression gasoline engines that potentially yield higher power. Fuel tank is a component of the car which needs exclusive safety features. They should weigh as less as possible, but at the same time should be very strong and 100% leak proof. Nowadays the fuel tanks are manufactured from a composite in some motor racing. Thus, in this preliminary study we wanted to evaluate the compatibility of some fuels with carbon/epoxy composites.

2. Material and methods

Test 1: A mix of solid, bisphenol-A based epoxy resin, + liquid, bisphenol-A based epoxy resin, + DICY/Urea curing agents
Test 2: A mix of epoxy novolac resins, + solid bisphenol-A based epoxy resin, + DICY / Urea curing agents
In both cases, the formulations were used to impregnate carbon fiber fabrics, with the same RC and the same manufacturing cycle. The prepregs thus obtained were hardened with the same Hot-in Hot-out press molding cycle.

The compatibility of the composite systems with some fuels -listed below- was then evaluated by immersion in these fuels for 4 weeks, at room temperature. The percentage of weight variation between before and after the immersion period was then determined.
Fuel A: RON 98
Fuel B: RON 102

3. Results and Discussion

Percent weight change following 28 days immersion:

Type of Fuel	Test 1	Test 2
Fuel A	-0.150%	+0.250%
Fuel B	-0.700%	+0.225%

The system 1, 100% bisphenol-A based epoxy resin, showed a decrease in weight (degradation) by immersion in both fluids, and in a more accentuated way with the fluid with a higher RON number. The system 2, a bisphenol-A based epoxy resin and epoxy novolac resins mix, showed a low and very similar weight gain (absorption) in both fluids tested.

4. Conclusion

Given the growing use of carbon fiber epoxy composites in the construction of tanks, or other parts of vehicles that may come into contact with fuels, it is recommended that prepreg manufacturers better investigate the effects of different types of fuels, with different RON numbers, on composite laminates made with different types of epoxy resins.

References

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