

# Araldite®

build, bond, protect

Araldite® delivers instant performance advantage on road and track



## Case History

### Araldite® RTM system used to help produce carbon/magnesium wheels for high-performance vehicles

NRG Wheels Ltd, based in the UK, specialises in designing, manufacturing and marketing structural composites for the automotive industry.

The company recently produced a carbon/magnesium car wheel, invented to create a better driving experience based on improved handling and better impact resistance as well as reduced fuel and engine emissions.

This has been achieved by focusing on the two main components of the wheel; the hub and the rim. The forged, magnesium alloy based hub of the wheel has been designed to reduce the normal cast magnesium porosity and corrosion potential of the wheel to zero.

The other major feature influencing the wheel's design and performance is the carbon composite wheel rim. NRG Wheels developed and produced the wheel rim with the support of Huntsman Advanced Materials who selected and provided an Araldite® resin system especially adapted for Resin Transfer Moulding (RTM). The resin was also designed to achieve the highest level of targeted performance, defined by challenging criteria to deliver increased toughness and better impact resistance.

During the RTM process to produce the carbon rims, aerospace type carbon fabrics are put into a mould and injected

with epoxy resin. Specially-coated titanium fasteners working within specially-bonded bushes fasten the hub to the epoxy carbon fibre rim, so no additional auxiliary component bonding or finishing is required. Thanks to the quality of both the resin and the processing conditions, the visible outer side of the rim has an aesthetically pleasing surface finish, showing the carbon fibre pattern. The surface is protected from UV light and other environmental elements with a tough, high gloss lacquer paint finish.

Combining properties of toughness and high temperature resistance, the Araldite® RTM system assists in creating a carbon wheel that offers better impact resistance than metal wheels and has high fatigue resistance.

The carbon/magnesium wheel is 40% lighter than even the lightest aluminium or magnesium wheels. Substituting conventional materials with composites creates a direct primary weight reduction, allowing the carbon rims on the wheel to have a noticeable effect on a car's fuel economy, reducing fuel consumption and emissions while enhancing performance and handling. When tested on a Porsche with a 380 bhp engine, the carbon/magnesium wheels helped to achieve power savings of around 43 bhp, equating to an approximate fuel saving of 10%.

*“The special Araldite® RTM resin was ideal for this application in meeting the high strength to weight ratios required for improved impact resistance, allowing the carbon/magnesium wheel to take over two times the impact of metal wheels.”*

#### Application

- Araldite® resin system adapted for Resin Transfer Moulding (RTM) to produce carbon rim on carbon composite wheel

#### Special service conditions

- High performance composite able to deliver high strength to weight ratios and meet criteria for better impact resistance

#### Advantages for customers

- Weight reduction allows the carbon rims to have a noticeable effect on a car's fuel economy, reducing fuel consumption and CO<sub>2</sub> emissions
- Reduced moment of inertia and gyroscopic effects result in better vehicle handling both on and off road
- Carbon wheels take over two times the impact of metal wheels
- Carbon wheels are safer in road impacts as the tyre retains its air and can be driven safely, even after a major impact

#### Advantages over the competition

- Araldite® resin system meets the highest level of targeted performance and allows the wheels to offer resistance up to 1600 joules
- Excellent strength, heat, UV and chemical resistance

#### Huntsman Advanced Materials used

- Araldite® resin system

#### Customer Location

- United Kingdom

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Enriching lives through innovation



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Coupled with reduced fuel consumption and engine emissions, the reduced energy requirement for composites manufacturing compared to aluminium alloy manufacturing results in significant energy savings during the life of the product.

These wheel types reduce gyroscopic effects and the moment of inertia. This results in improved acceleration and braking with reduced stopping distances, better grip, lighter, sharper steering, improved wheel and tyre balancing, more stable tyre temperatures and pressures, as well as reduced fuel consumption and engine emissions.



*Composite wheels demonstrate up to 1600 joules when toughened Araldite® resin is used*

“The special Araldite® RTM resin was ideal for this application in meeting the high strength to weight ratios required for improved impact resistance, allowing the carbon / magnesium wheel to take over two times the impact of metal wheels,” said Bevis Musk, Research and Development Director at NRG Wheels Ltd.

“Thanks to the toughness offered by the Araldite® resin system, the wheel demonstrates resistance up to an impressive

1600 joules. In contrast to metal wheels, cracks do not increase and the wheel reverts to its round shape while retaining great strength, rigidity and the flexibility required for both road and track. This makes the wheel safer in road impacts as the tyre retains its air and the car can be driven safely, even following a major impact.”

The overall potential for carbon composite wheels is large, but specific. The wheels are suited to higher-value and high-performance vehicles. The instant performance advantage and simplicity of fitment makes the NRG carbon wheels a natural choice for highly tuned vehicles, either OEM or aftermarket.

The reduced moment of inertia generated by using composites also makes the wheel suitable for use on delivery vehicles and buses, where stopping and starting is frequent. For military applications, not only could carbon composite wheels prove useful in improving overall vehicle performance, it could also prove beneficial in ballistic response settings. When compared to metal wheels, in extreme blasts less shrapnel penetrates the vehicle equipped with carbon composite wheels.

RTM with suitable epoxy resin systems allow the production of reproducible high quality parts within acceptable cure times. The flexibility of this process also authorises new design ideas, such as the carbon wheel rim, which would not be possible with metal constructions.

NRG Wheels and Huntsman recently won the Sports and Leisure category of the JEC Innovation Awards 2011 for the carbon/magnesium wheels, in recognition of the innovative use of composites in high performance vehicle applications.

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