

DuPont Structural Adhesives Contribute to the Development of Smart Electric Vehicle Industry



Project

Electric vehicle manufacturer NIO believes in a brighter, positive future, and a more sustainable tomorrow. Choosing the right partner to help attain those goals was very important. With vehicle and component lightweighting in mind, NIO and a team from DuPont worked in collaboration to develop structural adhesives that are crash-durable. The team's success with lightweighting solutions for the ES6 model led to further collaboration on the ES8.

Challenges

Adhesion to Multiple Substrates

The new adhesive formulations needed to adhere to hot-forming aluminum and carbon fiber reinforced plastic (CFRP). While these two materials are excellent for lightweighting, their use in EVs has been limited by a lack of joining methods suitable for a mass production environment.

Safety, Strength, and Durability

The adhesive solutions needed to help ensure passenger safety in the event of a crash, as well as join dissimilar materials that would be durable for the life of the vehicle.

Manufacturing Limitations

Manufacturing requirements limited where bondlines could be located. DuPont technicians needed to account for the interaction of the structural adhesive with other spot joining methods. Additionally, no changes could be made in assembly to accommodate the solution.

Solution

DuPont customized two high-performance adhesives to solve the bonding challenges: DuPont™ BETAMATE™ 1840 CLV and DuPont™ BETAFORCE™ 2817 V1.

The unique epoxy grade of BETAMATE™ 1840 CLV is a one-component heat cure structural adhesive for general metal joining in body-in-white applications. Application of this adhesive reduced panel thickness and allowed the use of an aluminum with higher strength and energy absorption. BETAMATE™ 1840 CLV also offers excellent weldability and wash-off resistance.

The properties of BETAFORCE™ 2817 V1 mitigate thermally induced distortions due to material coefficient of thermal expansion mismatch.

Results

The development of BETAMATE™ 1840 CLV structural adhesive and BETAFORCE™ 2817 V1 composite bonding solutions helped achieve NIO's target weight reduction, performance, and sustainability goals.

Significant Weight Reduction

Use of BETAMATE™ 1840 CLV resulted in a weight reduction of 2Kg which is 20% lighter than the baseline. Also, for the rear lower underbody CFRP component, use of BETAFORCE™ 2817 V1 resulted in a weight reduction of 3.5Kg—40% lighter compared with the baseline.

Worldwide Recognition and Awards for NIO

NIO has earned worldwide recognition for their EVs. The NIO ES8 earned the third place award in the 2019 EuroCarBody premium segment and the 2019 Car of the Year by Sohu Auto PRO Awards. The NIO ES6 was named one of the Top 3 Greenest Cars of the Year by China Car of the Year. These are just a few of the many awards the NIO ES6 and ES8 have earned in the last three years.

DuPont is China's Supplier of CFRP/Aluminum Bonding Adhesives

DuPont is a supplier of adhesives for CFRP and aluminum body-in-white component bonding in China, with a broad portfolio of adhesives including our crash-durable structural adhesives BETAMATE™1840 CLV and BETAFORCE™ 2817 V1.

BETAMATE™ structural adhesives deliver advanced solutions for bonding similar and dissimilar substrates, closures, and body structures, enabling improved load carrying capabilities, vehicle stiffness, durability, design flexibility, and weight reduction.

For high-performance bonding in lightweight multi-material vehicles, BETAFORCE™ composite bonding adhesive enables significant weight reduction, acoustic performance, and corrosion protection. Design flexibility is maintained while processing performance and sustainability goals are achieved.

Additional DuPont products specifically address opportunities in lightweighting, thermal management, safety, acoustics, vehicle structure/durability, sensing, control, and connectivity.

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