Whitepaper

Envalior
Imagine the Future

DRIVING *ON AIR*

Revolutionizing air suspension systems with advanced plastics.

Electrification continues to be a major disruptor across the automotive sector. Modern electronics have already had a profound impact on the transmission, fuel and exhaust systems, and the industry is now exploring the role software can play in improving the suspension system—particularly for electric and hybrid vehicles (EVs).

The suspension system remains a critical component of the vehicle. With traditional, passive suspension systems, the main design concerns center around structure, materials and tuning. Since the powertrain for an EV tends to be heavier than a combustion powertrain due to the weight of the battery, the suspension system of an electric vehicle needs to support 30% more weight on average[1], while finding the right balance between modern drivers' demand for an agile yet comfortable vehicle, and a superior driving experience.

Traditionally used in luxury and heavy-duty vehicles, actively controlled air suspension systems represent a significant technological advancement to the modern chassis as they improve safety by ensuring the car behaves predictably under various load conditions, support different drive modes,

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[1] "EVs are heavier than gas cars, but are they harder on roads?", University of Tennessee, Knoxville, Center for Transportation Research, https://ctr.utk.edu/evs-heavier-than-cars-are-they-harder-on-roads/#:~:text=So%2C%20how%20much%20heavier%20are,vehicles%20because%20of%20their%20batteries.

and dampen noise, vibration and harshness to provide the unique driving experience for which each car brand is known.

Collaborating with leading Tier 1s and molders, Envalior's cutting–edge materials and design and process expertise enable significant advancement across the automotive industry. Vehicle manufacturers are increasingly focused on solutions that enhance vehicle dynamics, comfort and sustainability. Air suspension systems address these needs, expanding their use to mainstream vehicle platforms, and meeting OEM demands for lighter and more cost–efficient components.

AIR SUSPENSION SYSTEMS — HOW THEY WORK

Air suspension systems provide distinct advantages over mechanical suspension systems.

While they offer high durability, traditional steel spring suspension systems lack the flexibility to dynamically adjust the vehicle ride height – especially to compensate for heavy loads. Springs provide a fixed stiffness that leads to compromises between comfort and performance, and their heavy weight impacts fuel consumption and emissions.

In contrast to metal spring suspension systems, modern air suspension systems use air springs with advanced electronic controls to dynamically adjust a vehicle's ride height and handling characteristics. These systems provide a more refined driving experience as the vehicle automatically adapts to different conditions. By lowering the vehicle at speed, the air suspension system helps improve the vehicle's aerodynamics to reduce drag and enhance fuel efficiency.

Air springs, together with sensor–based electronic controls, provide very precise steering over the vehicle's ride height, optimizing handling and ride quality. This ensures the vehicle remains level and stable under varying conditions to improve overall safety. Air suspension systems positively contribute to the key elements that matter to drivers today: dynamics, comfort, sustainability and safety.

PARTNERING TO *DRIVE INNOVATION*

It takes collaboration across the industry to drive change. Envalior works closely with industry leaders across the entire supply chain to drive innovation and advance air suspension systems. Together, they are working to replace traditional metal components in air springs with high–performance plastics that allow for more manufacturing flexibility, improved performance of the system, and reduced cost and weight.

As OEMs seek to meet regulatory requirements, they are also looking for solutions that provide a competitive advantage in terms of cost and sustainability. Advancements in materials technology provide the opportunity to adopt air suspension systems more broadly, and to meet OEM demands.

INNOVATIVE MATERIALS FOR EVERY APPLICATION

Our portfolio of materials covers a broad range of high–performance plastics including polyamide 6 (PA6), polyamide 66 (PA66) and thermoplastic elastomer (TPE). Dedicated compounds are designed to meet the specific challenges of air suspension systems, providing excellent thermal performance, high mechanical strength and outstanding chemical resistance. The materials demonstrate exceptional processability and weldability, crucial for air suspension system components that require leakproof components with high strength.

Designed to offer easy processing during manufacturing to ensure reliable production and long–lasting durability, our materials meet the demanding conditions automotive components face, including exposure to high and low temperatures, varying pressure levels and aggressive chemicals. In addition to our broad portfolio of material grades, we support customers through the entire application development process, including cost assessment, material selection, advanced computer–aided engineering (CAE), failure modes and effects \analysis (FMEA), prototyping and part design.

To support the drive for more sustainable approaches to manufacturing, Envalior offers a complete portfolio of bio–based and recycled materials, reducing the carbon footprint by as much as 50% over traditional alternatives, and helping to reduce emissions over the lifetime of the vehicle. Our portfolio includes material grades optimized for ease of processing, with a particular focus on welding capability to simplify manufacturing processes and enhance product reliability. The product roadmap aims at further reducing carbon footprints through the development of more sustainable material grades that meet the performance requirements of challenging applications in the automotive industry.

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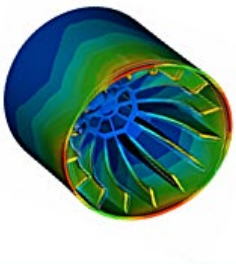
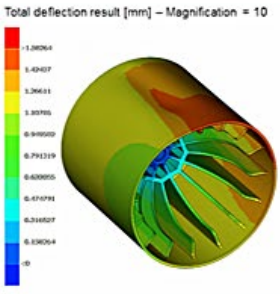
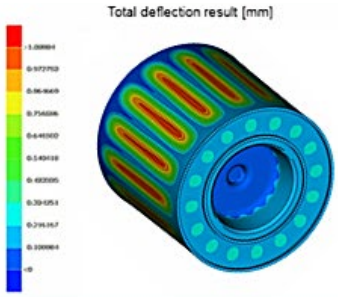
Modal Analysis



Impact Study



Pressure Analysis



Mold Filling Study

Envalior provides computer aided engineering and piston development support.

Air suspension system grades

AKULON® Ultraflow K–FHG0	DURETHAN® BKV60H 2.0EF
Formulated for ultra–high flow and easy processing	Formulated for ultra–high flow and easy processing
Excellent weldability	Excellent weldability
Superior mechanical strength and stiffness	Superior mechanical strength and stiffness
Excellent thermal and chemical resistance	Excellent thermal and chemical resistance
	Durethan BLUE BKV60 EF offers a stronger sustainability profile that more closely aligns to OEM demands

LEADING THE TRANSFORMATION OF AIR SUSPENSION SYSTEMS

The focus on improving fuel efficiency and reducing emissions remain essential considerations for OEMs facing increasingly stringent regulatory requirements.

As a trusted partner to the automotive industry, Envalior is leading the transformation of air suspension systems. The switch from metal components to advanced plastics provides significant benefits—improving vehicle dynamics, comfort and safety—and delivers on OEM demands for long–term durability, easy processability, and reduced cost and weight. As the automotive industry continues to evolve, Envalior remains committed to advancing air suspension technology and contributing to a more sustainable future for mobility.

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Learn more about our materials for air suspension systems.

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