



# Noise & Vibration Damping for eMobility

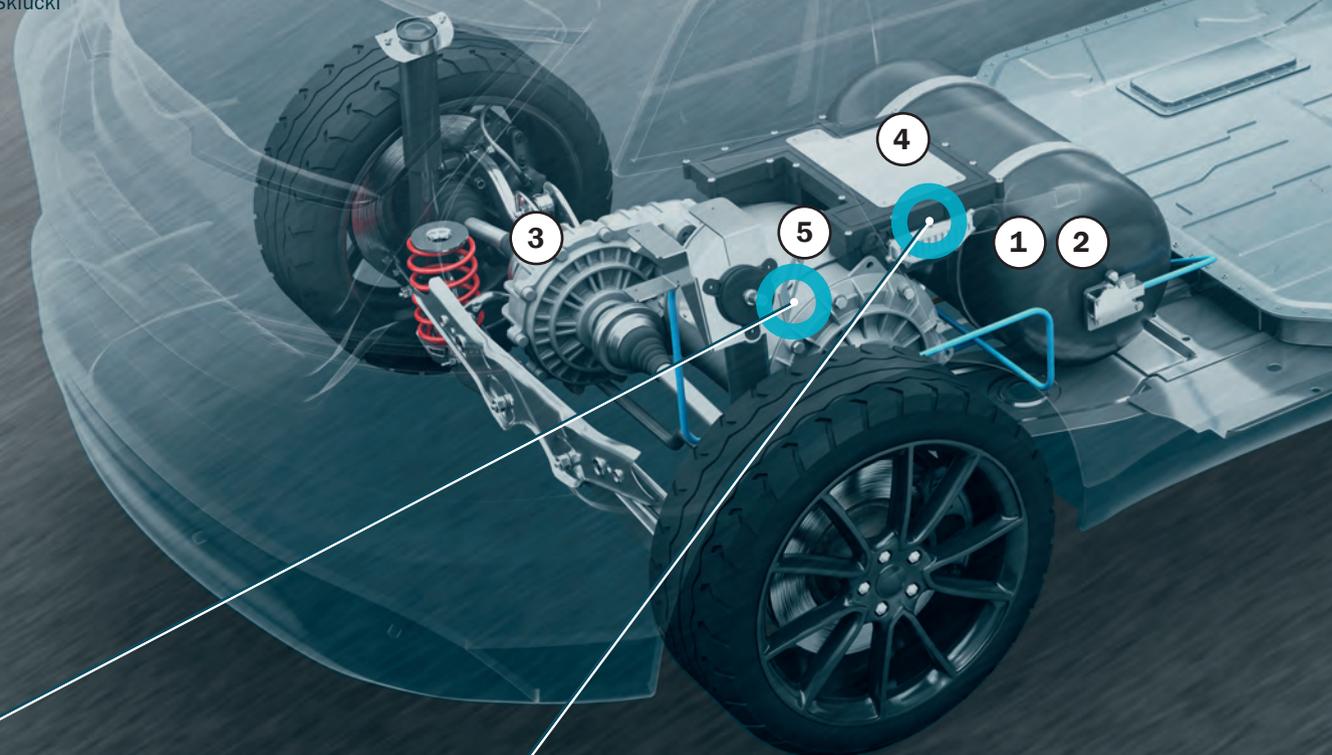


# Damping for eMobility



Damping of Noise, Vibration and Harshness (NVH) created during vehicle operation makes driving a more comfortable experience. Trelleborg Damping Solutions is an expert in eliminating unnecessary and unwanted vibrations through advanced material formulation and innovative laminate technologies.

By Jan Sklucki



## ELECTRIC DRIVES AND MOTORS, HVAC AND PUMPS

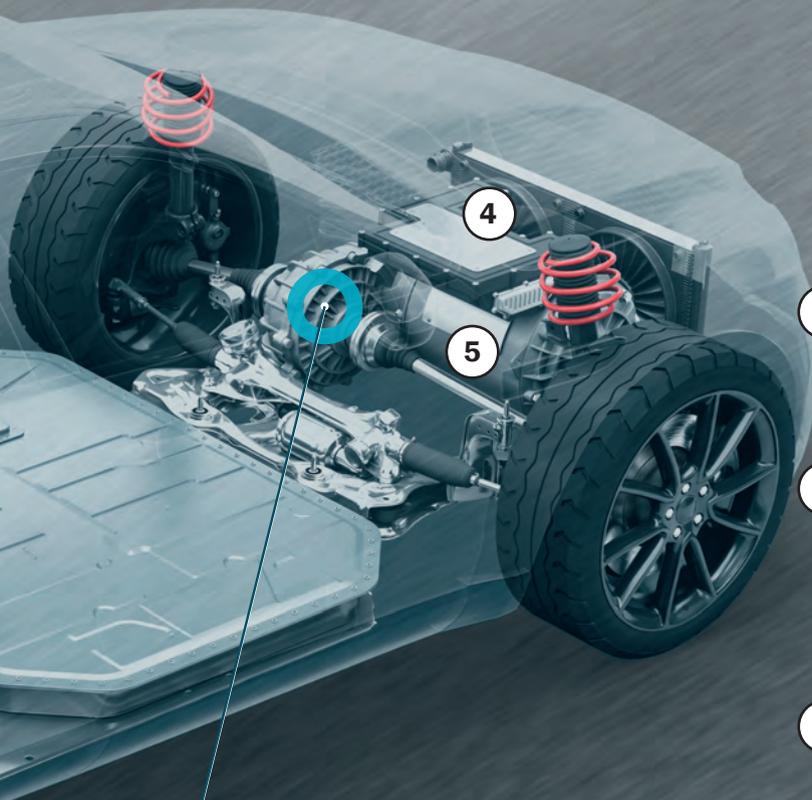
Applied Damping Material (ADM) is applied to surfaces that radiate excessive noise, providing superior structural damping reducing vibrations and radiated noise. If isolation is also required, Applied Damping Foam (ADF) combines damping and isolation to reduce structure-borne noise.

## COVERS FOR POWER ELECTRONICS, INVERTERS AND ONBOARD CHARGERS

Covers to protect electronic components are frequently sources of resonant vibration. To solve this, Visco-LAM or Duro-LAM materials are shaped using a special laminated process to form a new replacement cover that improves NVH performance without adding mass. If replacement is not possible, ADF or ADM can be applied to existing covers or to the housing to give effective damping.

**MORE INFORMATION**

Scan the QR-Code to learn more about Trelleborg Damping Solutions, or visit [www.rubore.com](http://www.rubore.com)

**GEARBOX,  
GEAR WHEELS**

A radial damper made from rubber-metal laminate adds damping to metal gear wheels, reducing tonal and whining noises generated during operation. Gear whining noise can also be reduced by minimizing the transfer of vibrations in between different components within the drive-line assembly.

**Trelleborg Damping Solutions**

NVH engineers are at your support to help you in the selection of optimal products to eliminate your NVH problem. Whether advanced materials, surface treatments or laminated composites, Trelleborg offers unique and customizable solutions to solve customers' most difficult NVH challenges.

**REPLACING RESONANT COMPONENTS OR DESIGNING NEW VIBRATION RESISTANT PRODUCTS**

Trelleborg Damping Solutions laminates can replace existing resonant components, such as mounts, brackets, washers and covers. Laminates that reduce (NVH) where it matters most without adding mass, offering robust and complex-shaped design options.

**1****Visco-LAM**

Visco-LAM is an advanced laminate material composed of an intermediate layer of customizable viscoelastic polymer. By modifying the properties of the polymer and choosing the right metals and alloys, the solution can be tailored to the application.

**2****Duru-LAM**

When a strong and robust material is required, Duru-LAM offers increased media resistance and improved mechanical properties. A range of thicknesses of different metals can be used around an interior layer of elastomer, providing the strength and performance needed to operate effectively within engines and transmissions.

**3****Rub-LAM**

To add sealing properties, components can be formed from two outer elastomer layers and an intermediate metal layer. Rub-LAM permits radial dampers, washers, seals and gaskets to be formed with improved noise reduction and damping.

**MINIMIZING VIBRATIONS IN EXISTING COMPONENTS**

When components can not be replaced, they can be modified by use of applied laminates to reduce or isolate vibrations.

**4****Applied Damping Material (ADM)**

A constrained layered damping material composed of layers of metal and rubber vulcanized together to form a strong and durable laminate that effectively reduces structural vibrations and radiated noise. It can be cut and formed to fit to most surfaces and shapes using conventional press operations, such as press forming, deep-drawing and die cutting.

**5****Applied Damping Foam (ADF)**

Metal and viscoelastic material are combined with a layer of closed cell foam to combine damping and isolation in a single material. Especially suited for use on stiff structures, such as cast iron or aluminum components, minimizing the radiation from vibrating surfaces.

# Technology Applied Damping Material

## Keeping Quiet

If you thought electric cars were silent, think again. Electric drivelines are certainly quieter than internal combustion engines, but they have their own noise and vibration issues. Thankfully, new technology from Trelleborg helps ensure a smoother, quieter journey.

By Andrew Montgomery

**WHEN ELECTRIC CARS WERE INVENTED,** many people thought the noisy world of the internal combustion engine would soon be history. Although electric and hybrid electric cars are quieter, it doesn't mean they're silent.

Electric drivelines have their own range of noise, vibration and harshness issues. And the noise of a typical combustion engine is no longer there to mask other structure-borne noises from the likes of the gearbox housing. But there's also another culprit.

"Power inverters are one of the main contributing sources of noise in the electric vehicles' driveline," says Reine Axelsson, Product Manager for laminates for damping solutions within Trelleborg Sealing Solutions.

### **Reassuring sound of silence**

This worries automotive industry Original Equipment Manufacturers (OEMs) and their component suppliers. E-Mobility is a fast-growing market, and the last thing they need is a noisy car that puts off potential consumers. →



**ARVID NORBERG**  
 Director of Sales and Marketing for  
 Trelleborg Damping Solutions

**Above:** When the noise of a combustion engine is no longer there to mask noises from the gearbox housing or power inverters, innovative solutions are needed.

When a component supplier had a power inverter noise issue, it approached Trelleborg for help.

Trelleborg's solution is based on the same basic technology used for brake shims. It's called Applied Damping Material (ADM), a constrained layer damping material that consists of metal layers that have been vulcanized together with rubber to produce a strong and durable laminate. Together, the polymers, rubber and adhesive are an excellent material to absorb mechanical energy and the vibrations that radiate noise.

It works on all sorts of vibrating structures in automotive drivelines, but Trelleborg has come up with a new variant of ADM for the power inverter issue.

### Secret recipe for success

"We've developed a completely new material for inverters because they make a wider range of noise," says Arvid Norberg, Director of Sales and Marketing for damping solutions at Trelleborg. "By combining a different thickness of metal with different types of polymer thickness you can have a higher level of damping at a wider noise frequency and temperature."

The exact material composition is secret. Suffice it to say, the polymers are based on nitril butadiene rubber (NBR), and the adhesive is typically an acrylic, though other materials can also be involved.

But it's a challenging development process because electrical engines and drives have even tougher cleanliness standards than combustion engines.

"The most critical thing is that there are no loose metallic particles past a certain size, as these can get into the engine or even the electronics and cause a short circuit," Axelsson says. "We are asked to control the level of particles on the parts we supply."

Norberg adds, "We're talking about tenths of millimeters that are often invisible to the naked eye."

### Shock and future proof

With the growth of e-mobility, Norberg believes ADM has significant market potential. It underlines the decision of Trelleborg Sealing Solutions several years ago to diversify from brakes and solidify its market-leading position in



**Above:** Rickard Jonasson, NVH Engineer adjusting the laser vibrometer for testing.



Scan the QR code to watch the film and learn more.



### About Trelleborg Damping Solutions

Headquartered in Kalmar, Sweden, Trelleborg Damping Solutions is the world leader in the manufacture and development of products to reduce brake noise and vibrations in automotive OEM and industrial applications. Alongside a program of brake shim solutions that covers all major car platforms available today, the company is also the market leader in the innovation of rubber-to-metal sandwich composites.

Apart from their excellent noise damping, these materials offer compressibility, sealing capacity, strong adhesion and vibration insulation, as well as thermal, chemical and mechanical stress resistance.

### FACT

## Turn off that noise!

- Sound is a physical disturbance in the surrounding medium in the form of rapid pressure variation.
- Noise is defined as any sound that's perceived to be disturbing. It's audible air pressure, where a very small vibration (in this case, from the power inverter) interacts with the surrounding air to cause a sound wave that eventually reaches the human ear. "It's just like the speaker of a sound system," says Reine Axelsson.
- When something oscillates about a static position, it can be said to vibrate.
- Constrained layer damping works by using a visco-elastic damping layer that is constrained (held down) by a metal layer.
- Vibrations in the structure will cause deformation in the constrained layer.
- Damping occurs due to shear deformation in the damping layer.
- Mechanical energy (vibration) is transferred into a small amount of heat in the damping layer (structural damping).
- Trelleborg's Applied Damping Materials lower the vibration in the structure, reducing the ability to transmit the vibration into the air. "You're lowering the volume of the speaker," says Axelsson.

damping solutions. The team working in this area is growing too.

"We are at the forefront of the market, and we see e-Mobility as being very important in the years ahead," says Norberg.

So how will the technology develop?

"We're using more lightweight materials wherever possible," says Axelsson. "Our focus is noise and vibration, but we are also looking to see how we can respond to other new requirements that come from our customers. There are also new workplace directives on noise from the European Union to consider. The health and safety requirements regarding noise and vibration are only getting tougher, but that's good for us as we're regarded as the leading developer of brake and damping products."

With the possibility of this technology being used in other industries, such as consumer electronics, it's clear that ADM has enormous potential, keeping Trelleborg ahead of the competition.

# Minimizing Gear Whine Noise



**Above:** A problem area in gearbox/engine assemblies today is how to reduce whining noise from gear boxes. The radial damper solves this.

Gear wheels often resonate from gear impact or transferred vibrations, leading to whining noise. Gear wheels respond well to applied damping using our Radial Damper.

## Description

The Radial Damper is a solution for noise and vibration damping of gear wheels. The product was developed as a solution for the growing challenges of e-Axle whining noise.

## Why does it work?

The formed, laminated, damping material is mounted inside the hollow surface of the gear wheel to radially add damping to the gear wheel. Damping takes place in the rubber, shear damping, as well as in the area between the gear wheel and the rubber, friction damping.

## Competitive advantage

Optimizing the gear wheels to minimize vibrations (tooth contact surface, tolerances etc.) is complex, time consuming

and expensive. On top of that, the consistency of the result may vary. The structural damping with the Radial Damper could in most cases fully replace this optimization and still meet the noise requirements.

## Distinguished manufacturing concept

The rubber is laminated and vulcanized to the steel using Trelleborg's unique production method. The master coils of the laminated material are cut down to the desired width, which in turn is used to stamp/form the finished Radial Damper, a robust product for demanding environments.

## The Radial Damper

- Made in our unique material allows efficient damping close to the source.
- Effective in reducing tonal as well as whining noise.
- Interferes the vibration path between different components of the gearbox/engine assembly.
- Cost efficient damping compared to alternatives.



**Contact Details**

Scan this QR code to save our contact details.



**TRELLEBORG**

We are part of the Trelleborg Group, which is the world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

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