What Tomorrow Sounds Like in Vehicle Interiors
A brief history – and future – of NVH materials in automotive applications

With automotive trends such as electrification, ride sharing and others emerging across the globe, it's safe to say that managing noise, vibration and harshness and buzz, squeak and rattle issues in automotive interior spaces used to be a lot simpler.

Throughout the 1990s, NVH reduction efforts were largely centered around cavity filling materials. These were relatively heavy – a deal breaker today – and they often were not flexible enough to completely fill the spaces inside auto doors or under headliners where engine and road noise could filter into the cabin. These legacy materials also absorbed water, which in enclosed spaces left the potential for mold over time.

Still, these early NVH materials did reduce the noise inside the automobile. Reduced interior noise quickly became a selling point for new vehicles.

Enter BMF
A significant next step in NVH reduction material came in the form of a non-woven blown microfiber (BMF). Developed by 3M, this new material set was a series of mat insulation featuring an internal web composed of polyester (PE) and polypropylene (PP) fibers. The extremely fine PP fibers allow for high-energy absorption without adding weight, and the PE fibers add loft, strength and stability. The material brought compressibility to the installation process, expanding to completely fill cavities, and the hydrophobic properties of the material virtually eliminated water absorption as a concern in NVH. The material also introduced opportunities for converters – it could be cut and shaped into exact forms to fill very specific spaces.

Known worldwide as 3M™ Thinsulate™ Acoustic Insulation, this non-woven BMF material fit naturally into early trends that are emerging today. For example, reduction in weight generally hurts NVH performance – lower mass and inertia reduces the ability of the vehicle to absorb outside forces. So the ability of the ~~foam~~ non-woven web to absorb vibrational sound at very low basis weights have been especially important for OEM's ongoing lightweighting efforts. It also helped set the stage for further study and test methods for suppliers and OEMs to understand the nature of sound inside vehicles of different sizes and designs.

Other Current Trends

According to Grand View Research, NVH materials as a segment were estimated globally at about USD $8.2 billion in 2015. At the same time, automotive markets continue to grow in the US, Europe and especially the Asia-Pacific region. This means that current NVH material suppliers, like many others in the automotive space, must suit a range of rapidly developing trends. In Asia and particularly in China, "luxury" is a constant demand – this is especially true in areas where, even if people still own their own vehicles, they retain drivers rather than driving themselves. Similarly, ride sharing – meaning a decreasing number of car owners and increasing users per vehicle – demands environments suitable for multiple conversations within the space.

The trends toward autonomous vehicles and electrification regarding NVH cannot be underestimated. The interior of the vehicle is rapidly becoming a link between, and even an extension of, home and work. It's becoming a connected source of entertainment, shopping, and personal interaction where the steering wheel is no longer the focus. And, as electrification reduces engine noise inside the vehicle cabin, it increases the road noise that passengers did not notice before.

Research and Testing Facilities

All of this has created the need for a deeper understanding of sound behavior inside the vehicle. Manufacturers and OEMs continue to develop enhanced measurements and understandings of sound pressure and dimensional sound, especially within closed cabins. Now, NVH products are developed based on software-generated models which require ever-more-advanced facilities. For example, 3M maintains an 11,200-sq.-ft. E-A-R Acoustic Technology Center (ATC) in Indianapolis, IN, USA, which provides the ability to test and validate materials in a range of recreated acoustic environments. These include "open road" which isolates the sound of the automobile in operation. Other features include an anechoic chamber for noise transmission loss testing and a reverb chamber for measuring randomized noise.

Upcoming Products

It's becoming clear that electronics-related NVH issues including display protection, gasketing and haptics will be more of a concern, especially around instrument panels with minimal gap space. This will result in very slim profile NVH materials (often just fractions of a millimeter), as well as elastomers for isolation mounts protecting infotainment and other electronics. Manufacturers are also currently exploring resin-free fibrous materials for barriers, and thermal acoustic solutions with additional materials that absorb environmental VOCs.

Also, as products that deliver sound absorption – the elimination of sound by trapping vibrational sound waves and transferring them into ambient heat – have made up a big part of the NVH space, a related area of exploration is damping, or dissipating vibrational energy before it can become sound. The latest damping products are self-adhesive materials that are flexible and repositionable for curved areas.

For more information on NVH, BSR or damping products, contact your 3M representative.

http://innovationintelligence.com/automotive-trends-presenting-challenges-for-nvh-engineers/

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