



OCV™ Reinforcements

Silentex® A Lifetime of Exceptional Acoustic Performance

Silentex® Noise Control Solution for Vehicle Exhausts





The need for more effective, lighter silencers... at reduced cost

The emphasis on quiet motor vehicles has increased significantly in the last few years through governmental regulations around the globe. In addition, in the eyes of the consumer, quiet cars are often associated with quality cars. Thus, automotive manufacturers and exhaust suppliers are taking a closer look at the technology involved in vehicle silencers or mufflers*.

But it's not just a matter of making silencers more acoustically effective. Many other requirements are important. Automotive manufacturers are striving to reduce vehicle weight. Constraints are being put on the space available for silencers. Fuel efficiency demands are increasing. And on top of all these requirements, costs need to be reduced.

Consequently, a clear need has emerged for an exhaust sound dampening system that is more effective, more environmentally friendly, lighter in weight, and lower cost. To meet all these requirements, Owens Corning offers a total system approach to vehicle silencers, the *Silentex* noise control system.



*Depending on the geographic region of the world, the words "silencer" and "muffler" can be used interchangeably.

A lifetime of exceptional performance and durability

It is estimated that on a global basis, as many as half of the automotive vehicles produced have silencers that contain some type of sound absorbing material. This percentage of vehicles with silencer systems containing sound absorbing materials is continuing to increase. In addition, other types of vehicles such as motorcycles, ATV's, snowmobiles, etc. are utilizing sound absorptive materials to improve sound quality, reduce weight, reduce cost, and prolong the life of the silencer shell. The Owens Corning *Silentex* system is in the forefront of these applications.

Owens Corning has been providing sound absorbing materials for silencers for more than 25 years. We have extensively studied the market and the needs of our customers. We have expertise in assisting our customers in placing *Silentex* materials into silencers, in comparing *Silentex* materials with other materials, and even in the acoustic design of prototype mufflers through research we have sponsored at The Ohio State University. With the ever increasing temperatures of low emission exhaust systems, we have shown that traditional filling materials such as basalt wool and standard E-glass just do not have the thermal and chemical durability to stand up to the harsh conditions present in many of today's and tomorrow's exhaust systems.

The *Silentex* system for placing sound absorbing materials in silencers and the *Advantex* glass composition are an exceptional combination to use in solving the acoustic challenges of silencers over the lifetime of the vehicles in which they are used. The *Silentex* system together with *Advantex* fiberglass directly addresses the issues which other absorptive materials face in trying to last the lifetime of the vehicle. For example, the *Silentex* system utilizes continuous fiberglass filaments to fill chambers in silencers. Materials such as basalt wool and needle felt mats are made up of discontinuous fibers which have a tendency to blow out of the silencer. This tendency is often reduced by using stainless steel wool to protect the basalt glass wool or needle felt glass fiber mats. This adds cost and weight and reduces the volume available for the glass fibers to dissipate the sound waves in the exhaust gases.

The *Advantex* glass composition has higher temperature capability and greater resistance to the corrosive gases present in the exhaust system than any basalt wool glass fibers or standard E-glass compositions. Thus, it stays in

place in the silencer at higher temperatures and for longer times than competing fibrous materials.



The glass fiber roving in these silencers, filled with the Owens Corning Silentex noise control system, essentially is unaffected after six years and 270,000 km of service.

For more than 5 decades, Owens Corning has been a solution provider to the Automotive Industry and their suppliers. From the introduction of the fiberglass reinforced Corvette in 1953 to the latest Owens Corning materials and parts for acoustic and reinforcement applications, Owens Corning has grown to become the largest supplier of fiberglass based materials to the global automotive industry.

The *Silentex* noise control system integrates three proprietary technologies:

- The unique *Advantex* glass fiber roving
- A patented texturization process that produces thousands of separated filaments from a fiberglass roving strand
- A range of equipment and products to ensure efficient and accurate silencer production.



Three technologies for superior silencer performance and cost

Advantex® glass fiber for optimum performance

In addition to its sound absorbing properties, *Advantex* glass fiber offers higher heat resistance and higher acid corrosion resistance than traditional E-glass, and at a competitive cost. Its higher melting temperature than traditional E-glass means that *Advantex* glass fiber is particularly suitable for high temperature vehicle exhaust applications – even peaks in temperatures in excess of 800 °C (1470 °F).

Benefits:

- Excellent sound absorbency
- High heat resistance
- High corrosion resistance



Patented texturization process for speed and accuracy

At the core of the injection process is a nozzle that separates the single continuous *Advantex* glass roving and “texturizes” it into individual (up to 5800) – but still continuous – filaments, which are inserted into a silencer cavity. The acoustic performance of all fibrous materials is dependent upon the separation of individual filaments from each other. The *Silentex* system provides silencer manufacturers with well-texturized materials which optimize the acoustic performance of the fibers. This means that often times, less *Silentex* material is required to obtain comparable acoustic performance with competing materials.

- A cost effective solution for high quality materials
- Easily tailored to meet different silencer designs
- Potential for weight reduction



Filling equipment and parts for high productivity

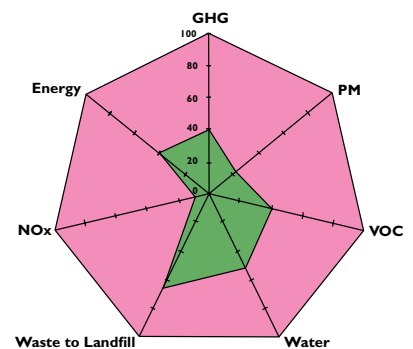
For exhaust manufacturers, the versatility of *Silentex* technology provides exceptional benefits. For example, *Advantex* glass fiber can be introduced directly into the silencer cavity. This offers the muffler manufacturer the advantage of less raw material storage space requirements and the lowest material costs. The *Silentex* technology can also be utilized to provide well texturized roving in plastic or glass fiber bags which can be hand stuffed directly into the muffler cavity without the need for specialized glass handling equipment. For many applications, preforms matching the geometry of the muffler cavity can be utilized to very efficiently introduce texturized glass into a muffler cavity without any significant modification to existing muffler manufacturing lines. Texturized roving can be provided for use in filament winding operations where muffler space constraints make the use of direct filling, bags, or preforms not practical.



- Direct filling machines
- Plastic or glass filament bags
- Preforms
- Boxes of texturized roving



Emissions and Resource Reduction Footprint for *Advantex* Technology



■ E-glass (Standard composite glass)

■ *Advantex* glass

GHG—Greenhouse gases

- Defined as gases which contribute toward the greenhouse effect, including carbon dioxide, methane, nitrous oxide and HCFCs including GHG from energy suppliers

PM—Particulate Matter

- Defined and reported according to regional government requirements

VOC—Volatile Organic Compounds, primarily hydrocarbons

Water—Water that enters the plant-sources include local utilities and wells

Energy—Electric power, natural gas, fuel oil



Global Supply and Support Services

The roots of *Silentex* technology spring from Owens Corning's 70 years of experience and expertise in sound and heat insulation. *Silentex* is a thoroughly tried-and-tested system. Since its launch in 1984, major automotive OEM's and Tier 1's as well as aftermarket exhaust suppliers around the world have specified *Silentex* because of its proven acoustic and thermal performance and its durability. The *Silentex* process and materials are also utilized in the smaller silencers found on Motorcycles, ATV's, Snowmobiles and in huge industrial process silencers where tens of kg of material are utilized in one silencer.

This broad experience base is backed up by a global network of comprehensive supply and support services. For example, we can:

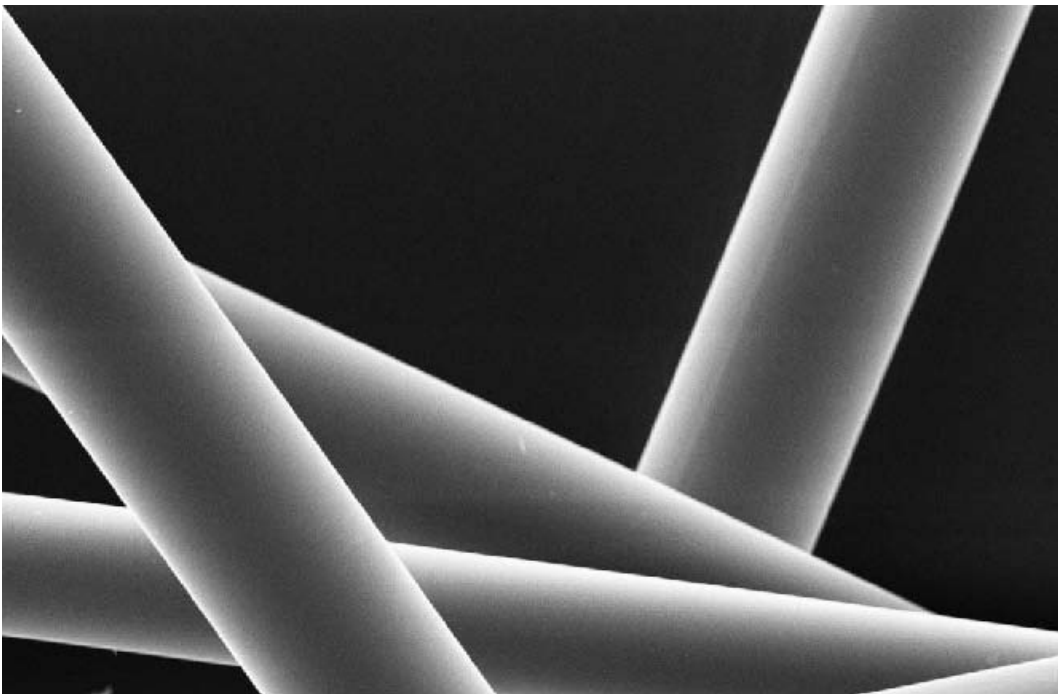
- Supply *Advantex* glass fiber to any type of silencer manufacturer located anywhere in the world from glass manufacturing facilities located on four continents. Of course, we offer product consistency from all of our manufacturing facilities regardless of where they are located.
- Help you decide the most cost effective method of placing *Silentex* material into your particular silencer design.
- Using the acoustic testing and *Silentex* filling facilities available in our Novi, MI facility, we can help you to determine the optimum amount of *Silentex* material to place in your muffler taking account of acoustic performance, cost, and material weight.
- Advise you on how to design your silencer to insure ease of filling.
- Based upon the long-term research on the acoustics of fibrous materials in silencers that we have sponsored for a decade at The Ohio State University, we can assist you in the acoustic design of your silencer.
- The Ohio State University research also helps us to advise you in the design of your silencer to take full advantage of the engine performance enhancements made possible by the use of fibrous materials in your silencers.
- Owens Corning's corporate scientific labs and analytical facilities staffed by hundreds of scientists and engineers can be tapped into to help you solve the most difficult technical issues you encounter.



The Owens Corning total system approach to silencers in all types of applications is exactly that. A total system approach that offers you everything you need for a unique noise control system. It comprises the patented *Advantex* glass fiber, filling machines, patented texturizing nozzles, a variety of products to help you introduce *Silentex* materials into your muffler, guidance in muffler design from both a filling standpoint as well as acoustic and thermal performance, start-of-the-art analytical facilities and equipment, fundamental research indicating the optimum ways in which *Silentex* materials can be utilized in silencers.



Analytical Scanning Electron Microscope (SEM)



Our Vision

Understanding the unmet needs of your customers is essential for the development of successful new product concepts in your business. To meet these needs and help you stay ahead of your competitors, Owens Corning will support your design process and concept commercialization activities.

Starting from an understanding of customer needs, our strategy involves new combinations of materials, equipment, processes and services, all of which go beyond today's common practices. Our approach represents a commitment from Owens Corning to your continued success.



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**OWENS CORNING
COMPOSITE MATERIALS, LLC**
ONE OWENS CORNING PARKWAY
TOLEDO, OHIO 43659
1.800.GET.PINK™
www.owenscorning.com
www.ocvreinforcements.com

Contact:
SingleEndRovings.ocvamericas@owenscorning.com

**OWENS CORNING
FIBERGLAS, SPRL.**
166, CHAUSSÉE DE LA HULPE
B-1170 BRUSSELS
BELGIUM
+32.267.48211

Contact:
SingleEndRovings.ocvmea@owenscorning.com

**OWENS CORNING - OCV ASIA PACIFIC
SHANGHAI REGIONAL HEADQUARTERS**
2F OLIVE LVO MANSION
620 HUA SHAN ROAD
SHANGHAI 200040
CHINA
+86.262.489.922

Contact:
SingleEndRovings.ocvap@owenscorning.com

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