Introduction of New Technology

Ultra-lightweight, Inorganic, Sponge-like Material with Excellent Sound Absorption

Research & Development Division

1. Introduction

In recent years various countermeasures have been taken against noise generated from factories and transportation facilities, which is regarded as "noise pollution" affecting residents of those areas. We offer sound-proofing technology as one of our "insulating and retaining" technologies and have contributed to a wide variety of noise control applications by manufacturing and marketing various sound-proofing materials. Examples include the ultra-lightweight sound-proofing cover for automobiles TOMBO™ No.6690-B "AIRTONE™" mainly composed of organic fibers, as well as inorganic fibrous sound-proofing materials (for residential and factory use) composed of rock or glass wool.

Recently, regulations on the noise produced by automobile operation have been enforced in most areas worldwide. To help companies comply with these regulations, sound-proofing materials require technological innovations to improve performance, heat resistance, and lightness.

Traditionally, inorganic fibrous sound-proofing materials are commonly used in applications that require excellent heat resistance; however, in order to achieve the required sound-proofing performance, an increase in weight may be required. Thus, demand for development of a lightweight inorganic sound-proofing material with high heat resistance has arisen. Sound-proofing technologies are divided into the main categories of sound absorption and insulation. We are currently developing an ultra-lightweight, inorganic, sponge-like material (hereinafter called "inorganic sponge") excellent in sound absorption (Figure 1). Here, we will highlight the properties and advantages of this technology.

Figure 1 Ultra-lightweight, inorganic, sponge-like material

2. Outline and Advantages of the Inorganic Sponge

2.1 Outline of the Inorganic Sponge

Electron micrographs of the inorganic sponge and the glass mat, a conventional inorganic fibrous sound absorbing material, are shown in Figure 2. The inorganic sponge has what is called a sponge structure, which is comprised of innumerable, cell-like voids of inorganic fibers. Using this unique internal structure, a lighter weight than

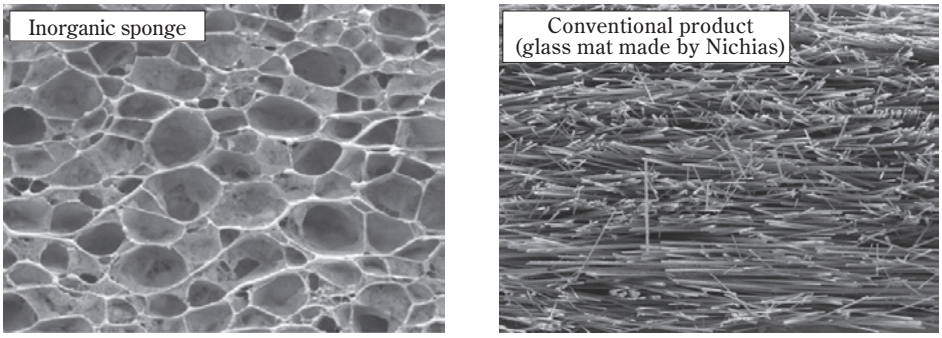

Figure 2 Structural difference between the inorganic sponge and conventional product

has ever been achieved was realized while maintaining the excellent heat resistance of inorganic fibers (Figure 3). In addition, this structure exhibits various advantages in performance over conventional inorganic fiber molded bodies in measures of sound absorption, heat insulation, sealing, compression/restoration, and other areas.

By changing the production conditions, the void size and bulk density of the inorganic sponge can be easily adjusted within the ranges of 0.1 to 0.5 mm and 0.005 to 0.03 g/cm^3, respectively. In addition, it can be made from various inorganic fibers such as glass fiber and rock wool, with heat resistance being equivalent to the type of fiber used.

Nichias' inorganic-fiber wet molding technology can be applied to the production process; thus, we are pursuing the development of production techniques for both flat and complex shapes of the inorganic sponge product in the future.

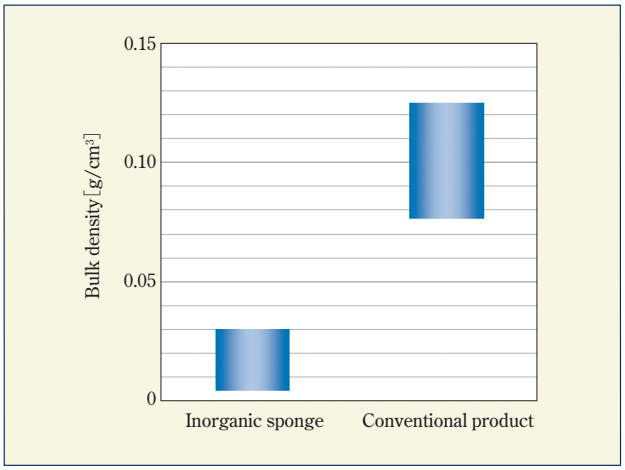

Figure 3 Bulk density of inorganic fibrous sound absorbing material

2.2 Sound Absorption Performance

This section details the sound absorption performance, one of the major advantages of the inorganic sponge.

Figure 4 shows the sound absorption coefficient data of the inorganic sponge compared to that of the conventional glass mat product. Table 1 summarizes the specifications of the test pieces that were measured. For the sound absorption coefficient, normal incident sound absorption coefficient in the rigid wall adhesion condition without

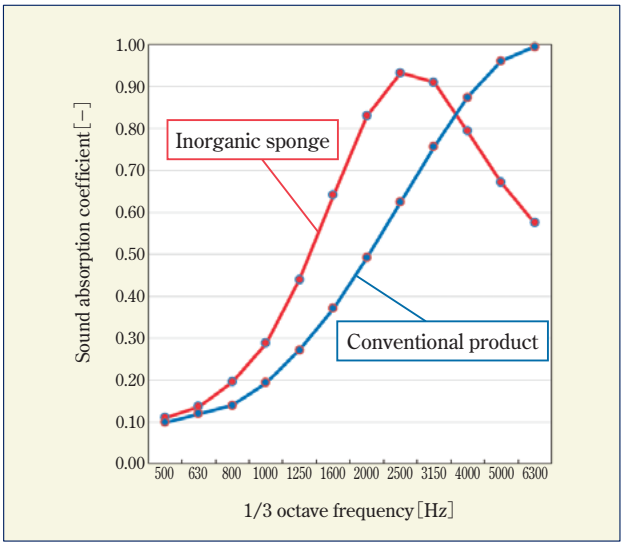

Figure 4 Sound absorption coefficient measurement results

Table 1 Specifications of the test pieces used in the sound absorption coefficient measurement

	Inorganic sponge	Glass mat
Bulk density [g/cm^3]	0.02	0.11
Thickness [mm]	10	10
Material	Glass fiber	Glass fiber

any back air layer was measured according to JIS A1405-2.

The test result shows that although the inorganic sponge had a weight (and bulk density) of less than 20% relative to the conventional glass mat, the sound absorption peak shifted toward the low-frequency side.

In general, the absorption performance depends on the mass of the sound absorbing material and the air flow resistance caused by the structure. Especially on the low-frequency side, a large proportion of the absorption performance depends on the mass, which has been a factor in weight increases. On the other hand, the inorganic sponge has an increased proportion of air flow resistance due to its unique sponge-like structure; therefore, irrespective of its low weight and density, it has excellent low-frequency sound absorption characteristics. The sound absorption frequency range is adjustable with a single piece of material because the flow resistance can be controlled by adjusting the void size using the production method mentioned above.

3. Conclusion

This report introduced an ultra-lightweight, inorganic, sponge-like material with excellent sound absorption, which is a new technology currently under development by Nichias. As a result of its light weight and ability to achieve heat resistance levels not provided by organic sound-proofing materials, it is expected to be applied in various fields including transportation equipment.

During the time this technology is under development, timelines for commercialization, sample supply, and pricing cannot be determined. As development progresses, we will incorporate customers' requests to further evolve this technology and strive to develop its applications. We welcome your opinions during this process.

If you have any questions or inquiries about this technology, please contact us at info-rd@nichias.co.jp.