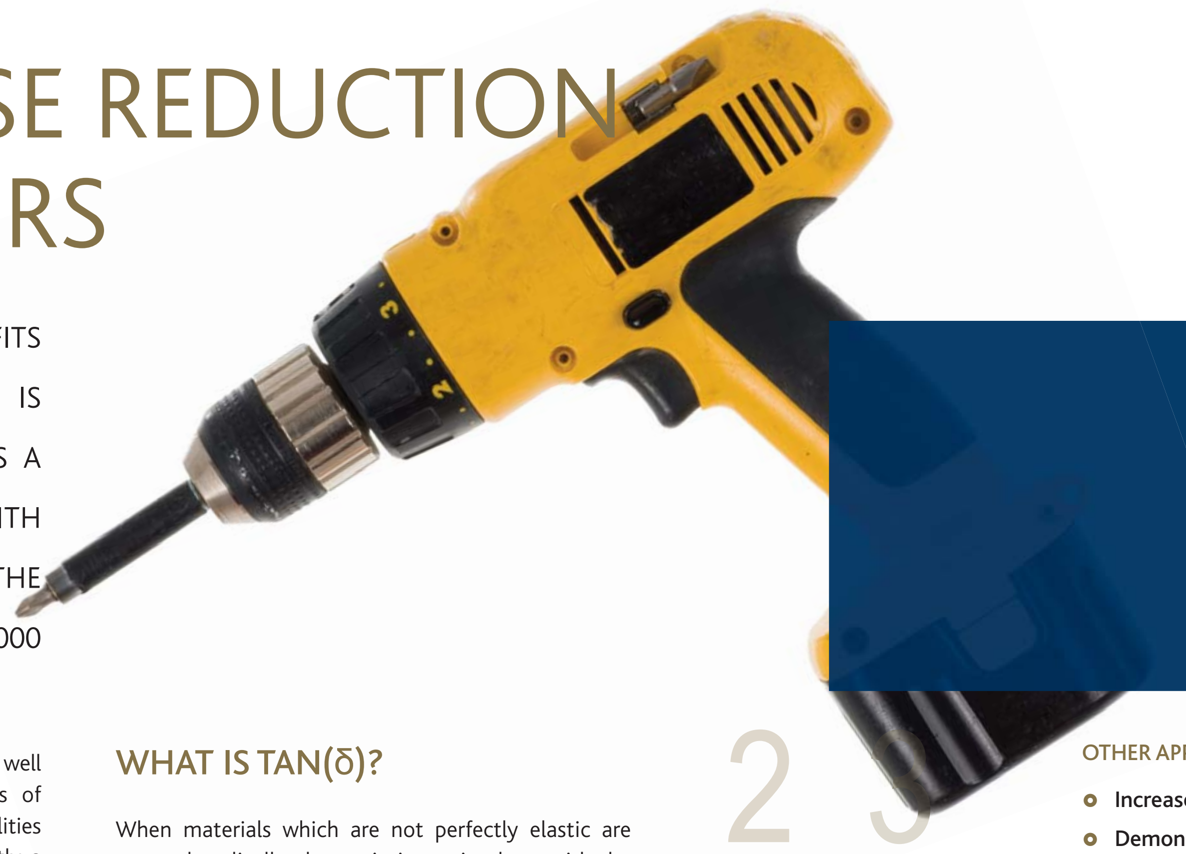
MICA FOR SOUND DAMPENING

MICA NOISE REDUCTION IN POLYMERS



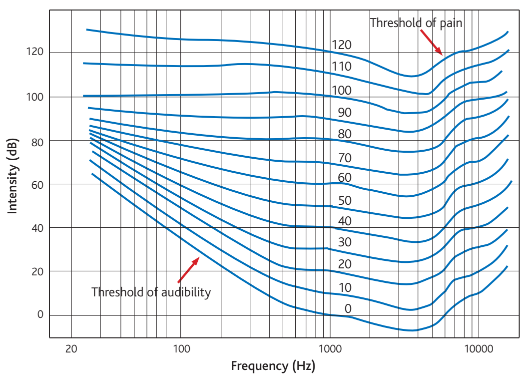
IMERYS MICA'S HAVE PROVEN BENEFITS IN NOISE MANAGEMENT. NOISE IS MOST FREQUENTLY DESCRIBED AS A NON PERIODIC WAVEFORM WITH EXTREMELY HIGH INTENSITY IN THE AUDIBLE FREQUENCY RANGE (20-20000 HZ) (FIGURE 1).

The reduction of noise in a given environment, as well as improvements in the mechanical properties of polyolefin based materials are important functionalities integrated into many products. There are currently a wide variety of sound proofing and sound deadening technologies in use. The (polymeric) materials used in the various technologies differ, but the principles used to create sound dampening and/or sound deadening effects are all similar and primarily based upon:

- **Increasing the mass of the vibrating (polymer) body by increasing its density, and as a result deadening sound.**
- **Increasing the ability of the material to convert sound waves transmitted at different temperatures, frequencies and intensities into surface heat (dissipation) - this property being measured as Tan (δ).**
- **Increasing the distance between the noise source and the receiver by increasing the thickness of the sound absorbing material.**

FIGURE 1 | THE AVERAGE RANGE OF SOUND INTENSITIES FOR HUMAN HEARING

(Source : Courtesy Bell Telephone Laboratories)



WHAT IS TAN(δ)?

When materials which are not perfectly elastic are stressed cyclically, the strain is not in phase with the stress applied. The phase difference observed is referred to as delta (δ). In each cycle of loading, there is energy dissipation in such materials. Tan(δ) is a measure of damping.

tan(δ) = f(frequency, temperature, stress (time), strain)

tan (δ=90°)	liquid	= + ∞
tan (0°<δ<90°)	visco-elastic	= 0 & + ∞
tan (δ=0°)	elastic	= 0

δ is the phase angle difference between strain and stress observed.

Many types of minerals can be used to achieve the maximum amount of heat dissipation (see tan(δ)) but as shown in figure 2, mica remains the most efficient product to create the maximum value for tan (δ).

The use of mica to improve the sound proofing characteristics of a polymeric compound is well known.

Typical mica sound proofing applications are:

- **Plastic housing for electric power tools**
- **'Under-the-bonnet' automotive parts**
- **Bitumen panels & liners for use in automotive and domestic appliances**
- **Water-based structural vibration damping coating for trains, boats, buses aeroplanes , cars and many other applications.**

In most cases, sound proofing is not the only property desired from a polymer based composite, it is therefore important to note that mica can also provide other application benefits.

APPLICATION BENEFITS OF **MICA**

OTHER APPLICATION BENEFITS OF IMERYS MICA:

- **Increased flexural modulus and strength**
- **Demonstrable cost advantages**
- **Improved heat deflection (HDT) performance**
- **Increased tensile strength**
- **Improved impact properties**
- **Decorative effects**

IMERYS recommends the following micas for sound proofing:

Application	European Mica	US Mica
Plastic parts (PP, N6,^)*	M880 K	L125 Suzorite 60S
Bitumen membranes	M880K	Suzorite 40S Suzorite 60S
Water-based coatings	MU 454	C 3000

Mica for 'under-the-bonnet' sound proofing.

Mica used in water-based structural vibration dampening coating for luxury motor yachts.

FIGURE 2

(Shucai et al Int. J. Polym. Mat vol 29 issue 1-1 pp37-42 1995)

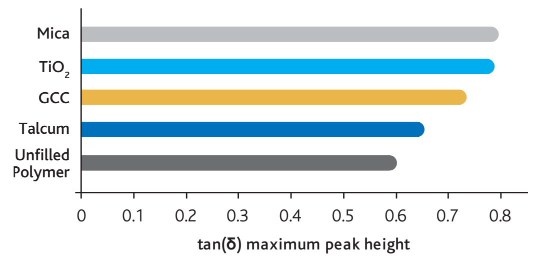
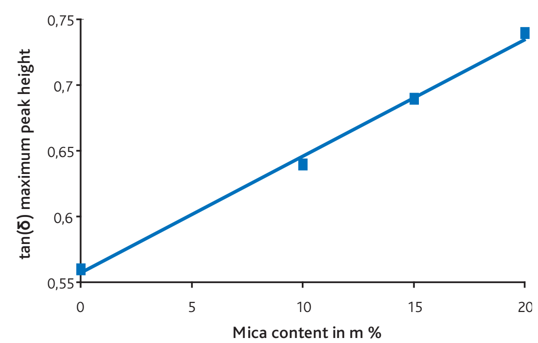


FIGURE 3

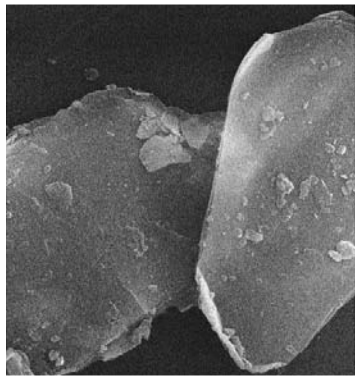
(Shucai et al Int. J. Polym. Mat vol 29 issue 1-1 pp37-42 1995)

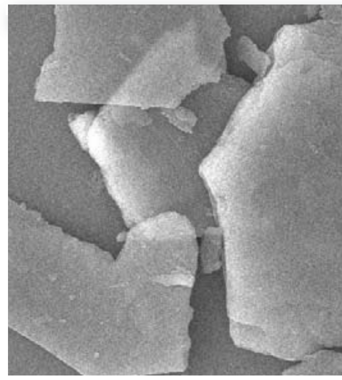


** See overleaf for technical work*

MICA IN PLASTIC NYLON 6.6 (N6,6) & POLYPROPYLENE (PP) TECHNICAL WORK

IMERYS phlogopite and muscovite micas, of varying particle sizes, have been investigated in a range of glass-fibre reinforced compounds of Nylon 6,6 (N6,6) and Polypropylene (PP). Selected grades of mica at different loadings generated sound dampening properties comparable to, or exceeding, glass fibre and, in every case, was superior to that of virgin resin.





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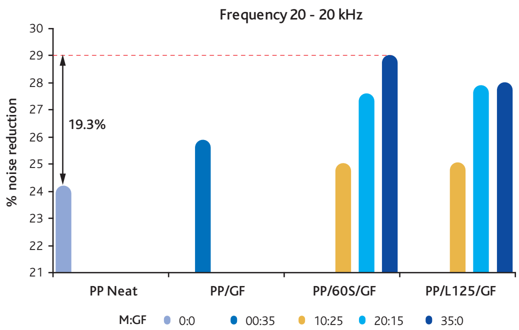
RESULTS

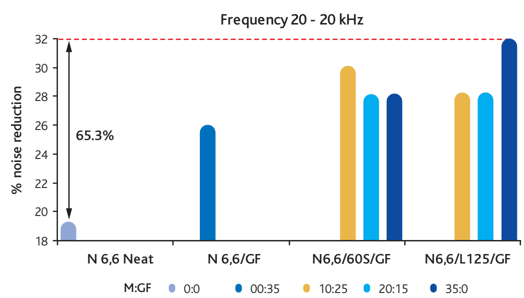
TABLE 1 | PP WITH MICA (M) & GLASS FIBRE (GF), NOISE REDUCTION IN %

M/GF	PP U/F	PP/GF	PP/606 /GF	PP/L125 /GF
0:0	24,3			
0:35		26,0		
10:25			25,1	25,1
20:15			27,7	28,0
35:0			29,0	28,1
Max. noise redn. vs u/f (%)		7,0	19,3	15,6

TABLE 2 | N 6,6 WITH MICA (M) & GLASS FIBRE (GF), NOISE REDUCTION IN %

M/GF	N6,6 U/F	N6,6 /GF	N6,6/60S /GF	N6,6/L125 /GF
0:0	19,3			
0:35		26,0		
10:25			30,2	28,2
20:15			28,2	28,3
35:0			28,2	31,9
Max. noise redn. vs u/f (%)		34,7	56,5	65,3





OTHER BENEFITS

- Improved heat resistance
- Low dielectric constant
- Improved corrosion resistance
- Easily moulded complicated parts
- Low thermal conductivity
- Reduction in mould shrinkage

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