PRECISION ACOUSTICS

Comparison of Encapsulants

Precision Acoustics Ltd is pleased to offer a range polyurethane materials for encapsulation of electronic components and for use as acoustic windows. The materials within this range cover frequencies from 2 kHz up to 1.5 MHz. All materials in this range are supplied as user-castable 2-part mixes. These materials provide a range of flexibility and durability and have acoustic impedances that are close to, or matched with, sea and/or fresh water.

Product	Description
Aptflex F3S	Very tough and durable encapsulants with excellent stability
Aptflex F7	Black, flexible encapsulants, rho-c matched to freshwater
Aptflex F13	Visually transparent potting compound, rho-c matched to freshwater
Aptflex F21	Black encapsulants balancing flexibility and toughness, rho-c matched to seawater

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THIS RANGE OF MATERIALS CAN BE USED IN APPLICATIONS SUCH AS:

- Front face encapsulation on transducers and arrays thereof.
- Acoustic windows and potting of hydrophones
- Potting of electronic circuits within underwater enclosures to provide additional waterproofing.
- Moulded strain reliefs on cable glands or at the rear of connectors
- Over-moulding of repairs to underwater cables.

RECOMMENDED APPLICATIONS

Application	F3S	F7	F13	F21
Hydrophone/Array potting	✓✓	✓	✓	✓✓
Transducer front face/potting	✓✓	✓	✓	✓✓
Sealing cable repairs	✓	✓✓	✓	✓✓
Connector strain relief	✓	✓✓	✓	✓
Encapsulating electronics	✓	✓	✓✓	✓

INSERTION LOSS

Insertion loss (IL) is defined as

$$IL = -20 \log_{10}\left(\frac{P_t}{P_i}\right)$$

where P_t is the amplitude of the acoustic pressure transmitted through a sample and P_i is the amplitude of the acoustic pressure incident upon it.

This has been experimentally determined for a 5mm thick sample of each encapsulant and this is shown in Figure 1 and in Figure 2 for frequencies below 1 MHz.

The dynamic range of IL measurement is approximately 40 dB and values higher than this cannot be guaranteed.

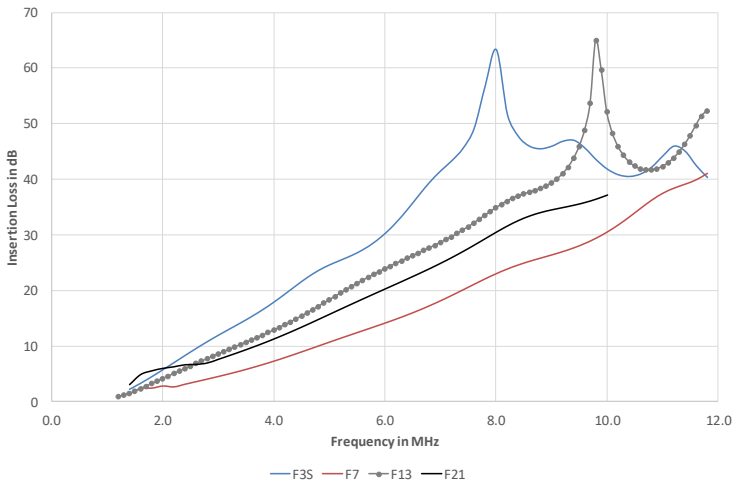

Figure 1 – Comparison of Insertion Loss for PA Encapsulants

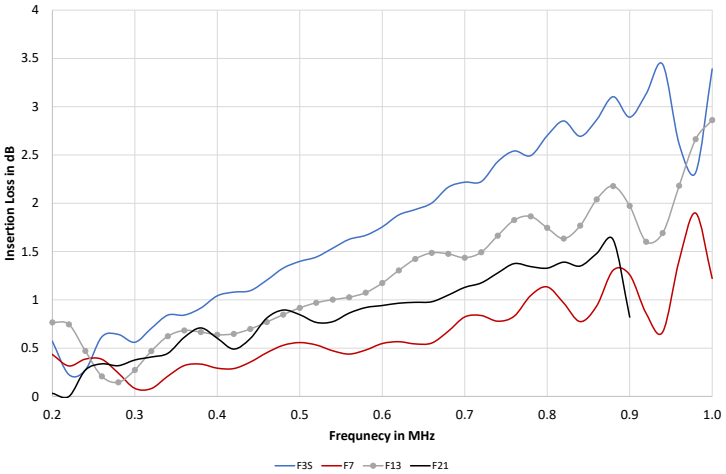

Figure 2 – Comparison of Insertion Loss for PA Encapsulants below 1 MHz

ATTENUATION

Attenuation (α) is evaluated from the measurement of Insertion Loss for 2 samples of the same material, but of different thicknesses. It is calculated as

$$\alpha = \frac{IL_1 - IL_2}{\Delta z}$$

where IL_1 is Insertion loss of sample 1, IL_2 is Insertion loss of sample 2 and Δz is the difference of between the thickness of the two samples. This has been experimentally determined for each encapsulant, and this is shown in Figure 3 and in Figure 4 for frequencies below 1 MHz.

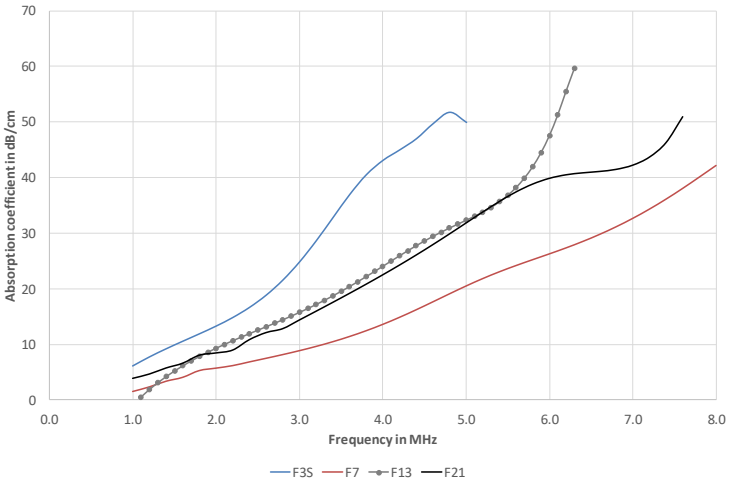

Figure 3 – Attenuation vs Frequency for Comparison of Encapsulants

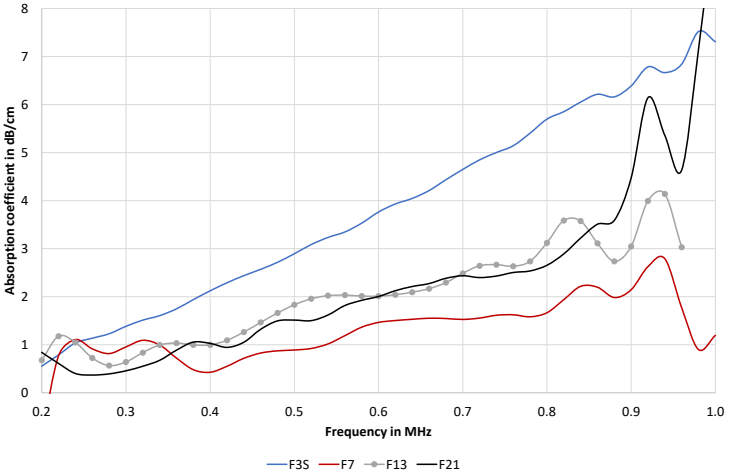

Figure 4 – Attenuation vs Frequency for Comparison of Encapsulants below 1 MHz

PHASE VELOCITY

Phase velocity is evaluated from the measurement of transit time across 2 samples of the same material.

This has been experimentally determined for each encapsulants, and this is shown in Figure 5 and in Figure 6 for frequencies below 1 MHz.

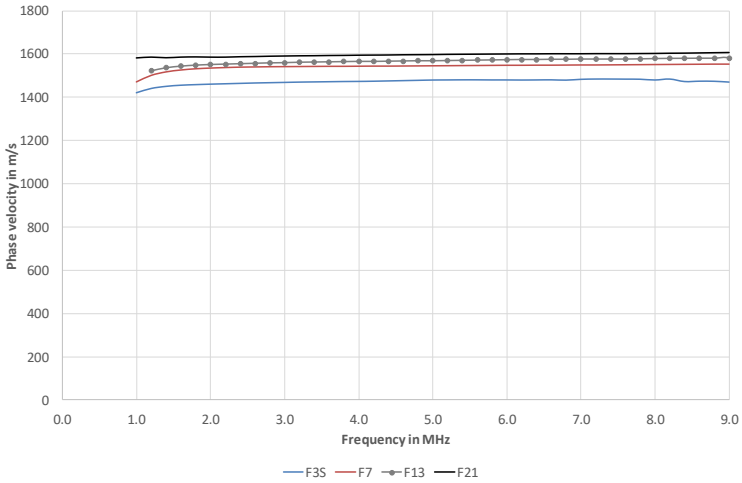

Figure 5 – Phase velocity vs Frequency for Comparison of Encapsulants

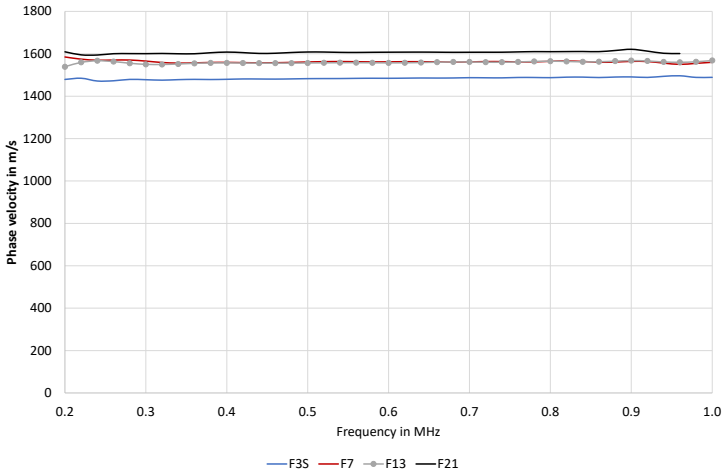

Figure 6 - Phase velocity vs Frequency for Comparison of Encapsulants

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