HYMAG'IN

FILAMAG™

Magnetic absorbing filaments for additive manufacturing

Discover HYMAG'IN

HYMAG'IN produces and sells several ranges of **innovative ferrite-based magnetic materials**. The products are ultra-fine powders or semi-finished products for additive manufacturing, such as magnetic filaments. HYMAG'IN products are aimed at aerospace, defense, automotive and telecom markets.

Ferrites are widely used in electronic systems. They are essential magnetic materials for passive components and solutions for electromagnetic compatibility (EMC). However, ferrite users face many challenges:

- **miniaturize to reduce weight and volume**
- **reduce their environmental impact and energy consumption**
- **secure their supply chains**

HYMAG'IN provides a solution to these needs by producing ferrites 100 times smaller, using a **unique, sustainable and low-energy technology based in Europe**.

FILAMAG™ is a range of filaments designed for the additive manufacturing of electromagnetic absorbing products.
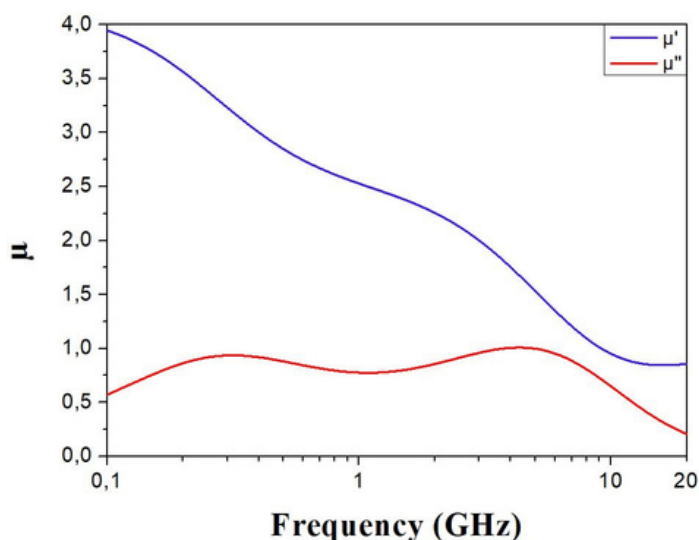
FILAMAG™
| Features

FILAMAG™ is a range of **magnetic filaments made from polymer filled with magnetic nanoferrite powders** NANOMAG.

HYMAG'IN has the expertise to integrate these powders into different types of rigid or flexible polymer matrices.
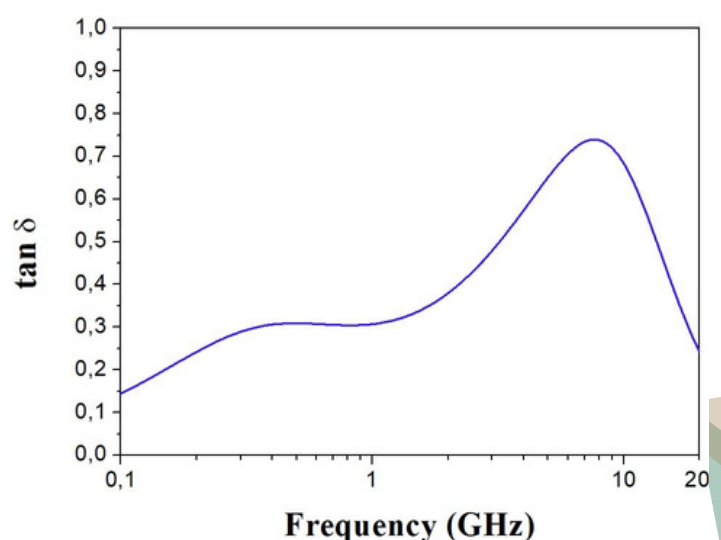
FILAMAG™ can be used with standard Fused Deposition Modeling (FDM) 3D printing technology.
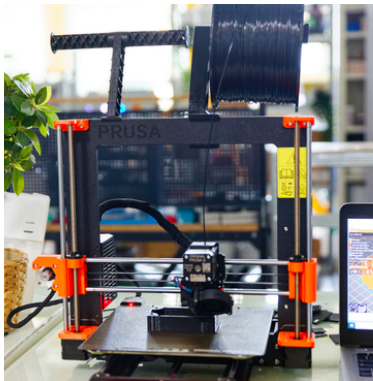
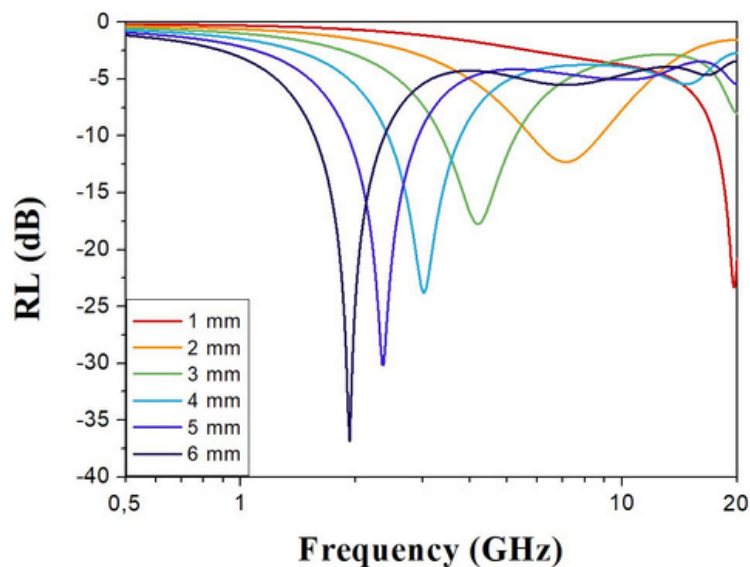|	FILAMAG-F
Composition	NANOMAG-Fe Flexible polymer
Loading rate	70% by mass
Extrusion temperature	230 °C
Printer bed temperature	45 °C
Type of printer bed	Textured
Nozzle (recommended)	1 mm
Diameter	1.75 mm
Permittivity at 1 GHz	ε' = 19.00 ; ε" = 3.86

Permeability (measured)

Loss tangent (calculated)

What you can do with FILAMAG™

CHOOSE THE OPTIMUM THICKNESS

Selecting a ferrite charge with appropriate electromagnetic characteristics is essential for optimum absorption. But that's not all! The graph below illustrates how varying thickness affects the reflection loss of the magnetic product. Simulations are required to select the optimum thickness according to the required frequency, performances and system dimensions.
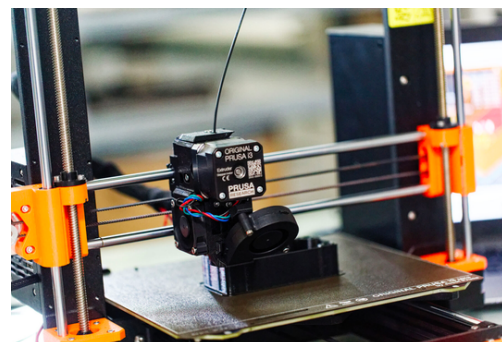

Reflection loss of a FILAMAG-F 3D sheet of different thicknesses (simulated)

3D-PRINT MAGNETIC CASING TO PREVENT CAVITY RESONANCE

HYMAG'IN uses these filaments to produce 3D electronic casings designed to protect electronic boards.

These casings protect the components while offering an alternative to traditional metal covers.


The metal covers reflect waves and are too heavy to meet the challenges of lightweighting systems. On the other hand, **the lightweight 3D-printed composite casing effectively prevents the transmission and reflection of waves by absorbing them**.

What you can do with FILAMAG™

3D-PRINT HONEYCOMB FOR A SPECIFIC FREQUENCY

In the quest for effective absorption of electromagnetic waves, custom-designed shapes play a crucial role. **By customizing the design of your 3D parts, HYMAG'IN targets absorption at the specific frequencies of your EMC requirements.**

Below the results of a 3D honeycomb pattern designed to absorb at 10 GHz: significant reflection losses of -45 dB around 10 GHz and a weight three times lighter than a 3D sheet of the same thickness.
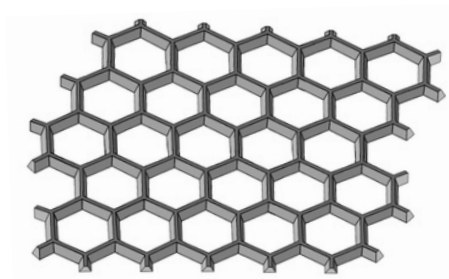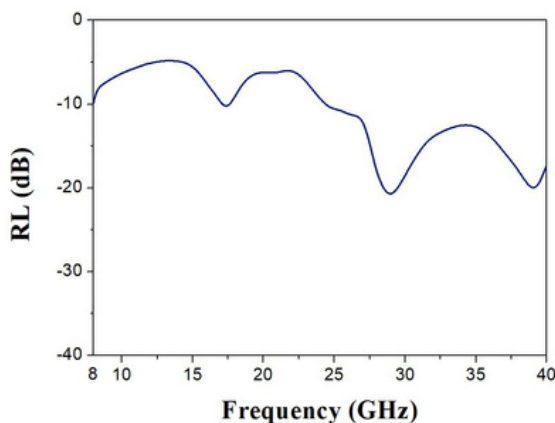

3D honeycomb
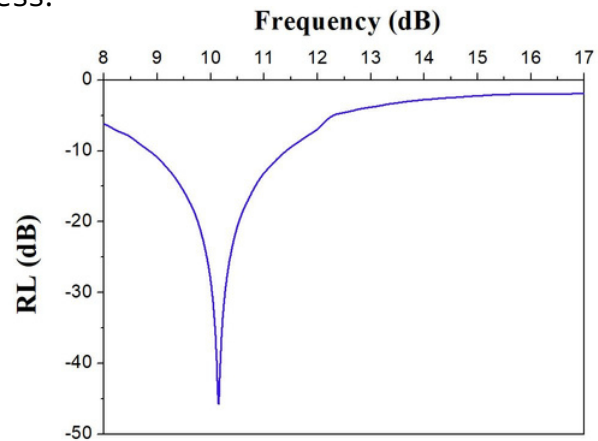
Reflection loss of FILAMAG-F 3D honeycomb (measured)

3D-PRINT BROADBAND ABSORBERS

After exploring designs for absorbing at a specific frequency, HYMAG'IN has developed a shape to extend the range effective frequencies. **With FILAMAG-F, this multilayer square structure absorbs broadband electromagnetic waves in the GHz range.**

Reflection loss of FILAMAG-F 3D multilayer square (measured)

This GHz broadband absorption is important in a variety of fields, such as anechoic chambers, radar cross section reduction, wireless communications and antennas.
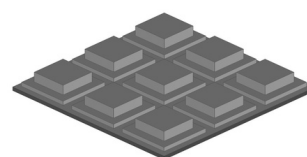

3D multilayer square structure

Why choose FILAMAG™?

Geometry selection to match the space complexity of your use case:

FILAMAG™ filaments enable to print absorbing parts as precisely as required to match the geometry of your electronic systems. The structure of the printed materials, micro-pyramids or honeycombs for example, and their dimensions are accurately calibrated during the set up of the 3D printing.
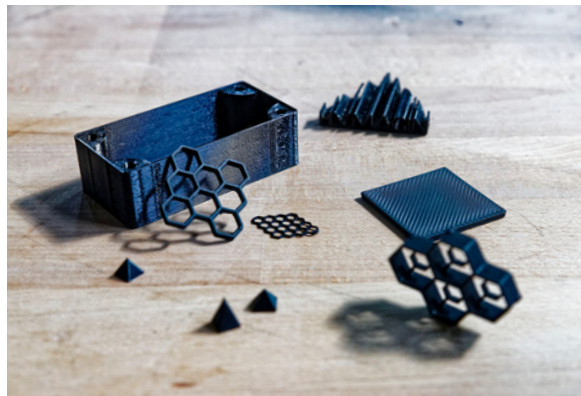
Performance optimization and weight reduction of your absorbers:

Through a relationship linking the geometry of the absorber and its interaction with electromagnetic waves, designing 3D-printed absorbers with FILAMAG™ considerably **improves their performance while lightening their structure**.

Parameters adaptation related to your required mechanical properties:

The chosen matrix for the filament and the loading rate of NANOMAG powder have a direct impact on the final mechanical properties of the printed part. **HYMAG'IN is able to adapt these parameters to suit user requirements**.

FILAMAG™-F stands out amoung other filaments by their mechanic flexibility. They are used to print absorber products that require flexibility for integration into the system and for use under mechanical stress, for example.

Contact us!

FILAMENTS AND OTHER ADDITIVE MANUFACTURING TECHNOLOGIES

Do you have specifications on filament properties? On the use of particular fillers and/or matrices?

Our experts are at your service to offer you a range of services to meet your needs:

- **Assessing the feasibility of filaments composed of other fillers/matrices;**

- **Analysis and execution of printing tests using the most suitable additive manufacturing method;**

- **Characterization of your 3D printed product;**

- **Development and optimization of your 3D printed product using our expertise in additive manufacturing.**

NEED MORE INFORMATION?
CLICK <u>HERE</u> TO CONTACT US

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