New Molypermalloy

Updating a Classic

Introduction

Molypermalloy powdered magnetic cores are among the oldest and best known powdered alloy materials in use [1]. For decades Molypermalloy (MP) cores have been the gold standard for powdered magnetic materials. MP cores are utilized in a wide variety of applications such as high Q low frequency inductors, magnetic sensors, filter inductors, high performance switching inductors and flyback transformers [2–5]. The use of MP cores is especially popular in mission critical applications like military, space or medical, where the stable and predictable behavior of MP ensures reliable and long lasting inductor designs.

As technologies evolve so do the needs for magnetic materials. The widespread adoption of SiC and eGan FETS are pushing switching frequencies to ever higher levels. To meet the needs of traditional and new applications at these increasing switching frequencies, Micrometals has dedicated significant research effort to improve upon the legacy Molypermalloy powdered material. Micrometals' new MP features improved magnetic performance compared to the legacy version without compromising on the magnetic properties that made this magnetic material so sought after in the first place.

New Material Performance

Micrometal's new Molypermalloy material features a more square saturation characteristic, allowing for a more stable inductance behavior at low magnetization forces, while maintaining the soft-saturation characteristics which makes powdered materials robust and fault proof in demanding applications. A comparison in the DC bias behavior between the old and new Molypermalloy material is shown in Fig 1a.

Through advanced processing techniques, Micrometals' managed to reduce both the hysteresis and eddy current losses in the new Molypermalloy material. Reduced hysteresis losses will translate to higher inductor Qs at low frequencies. The lower eddy current losses lead to higher Q at higher frequencies. The lower eddy current losses also lead to a more stable permeability vs. frequency behavior, making the material more suitable for high frequency sensors or pulsed inductors. The total core loss of the material is greatly reduced. This allows for more efficient operating in power conversion applications like PFC, buck, boost or flyback inductors. A comparison in core loss between the old and new Molypermalloy is shown in Fig 1b.

Applications

Micrometals' new Molypermalloy features the same stable inductance behavior vs. temperature and AC excitation as the legacy version. There is no compromise in performance in magnetic sensors or highly tuned resonant circuits when using the new version over the legacy material. In fact, the lower losses and more stable permeability behavior further improve on the materials performance in these areas. The new formulation is also available in temperature-stabilized versions on request, ensuring maximum inductance stability under varying temperature conditions.

The improved material performance translates to efficiency gains in power conversion applications. The greatly reduced core losses enable the use of MP cores in buck, boost, flyback or other switching applications at significantly higher frequencies.

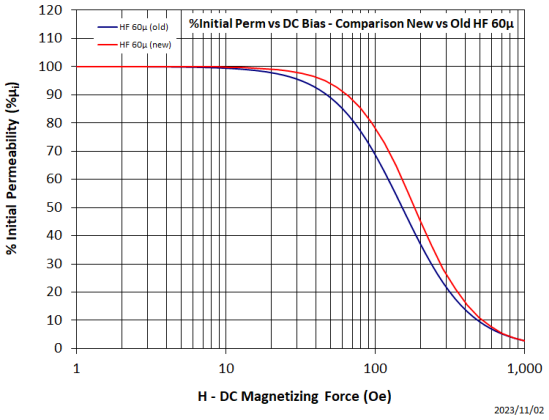
Conclusion

Micrometals' new Molypermalloy material represents an important step forward in ensuring engineers have the magnetic materials necessary to design compact, efficient and highly reliable inductors for modern power converters in mission critical applications.

For questions about the improved performance of Micrometals' Molypermalloy or any other material please contact **Applications@Micrometals.com**. For samples or quotations of this new material please contact **Sales@Micrometals.com** or your local Micrometals' representative.

Figure 1: Comparison in magnetic performance

(a) DC bias - legacy MP vs. new MP



(b) Core loss - legacy MP vs. new MP

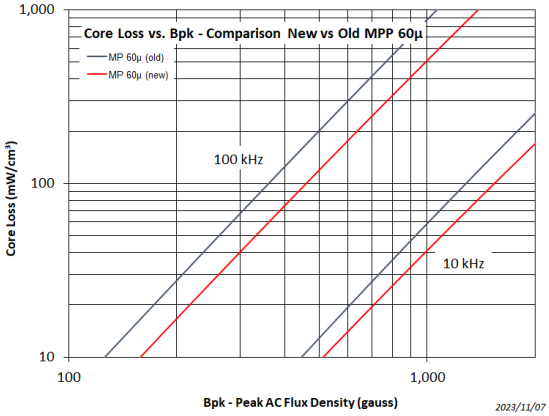
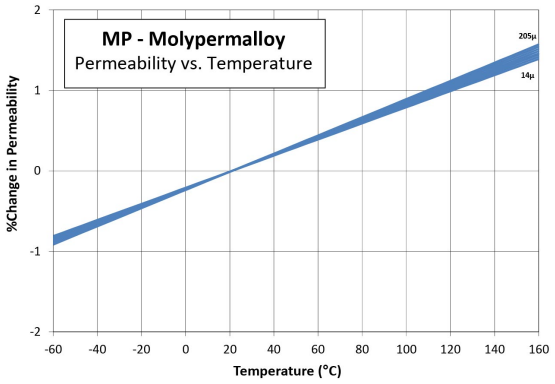
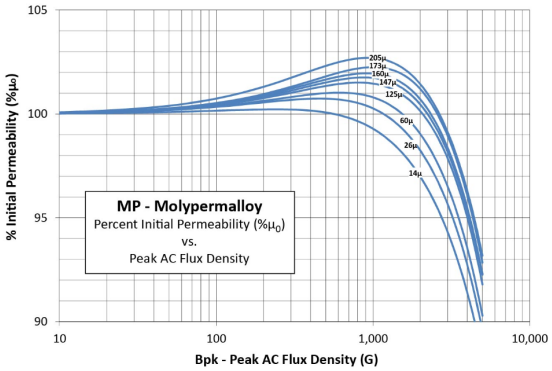


Figure 2: MP permeability behavior

(a) Temperature



(b) AC excitation



References

[1] R. Bozorth, *Ferromagnetism*. Wiley, 1993.

[2] W. T. McLyman, *Transformer and Inductor Design Handbook*. Boca Raton, FL, USA: CRC Press, 2011.

[3] T. Lyman, *Metals Handbook: 8th Edition, Vol. 1 - Properties and Selection of Metals*. Ohio: American Society for Metals, 1961.

[4] V. E. Legg, "Analysis of quality factor of annular core inductors," in *The Bell System Technical Journal*, vol. XXXIX, no. 1, 1960.

[5] W. Hurley and W. H. Wölfle, *Transformers and Inductors for Power Electronics - Theory, Design and Applications*. New York, NY, USA: John Wiley & Sons, 2013.