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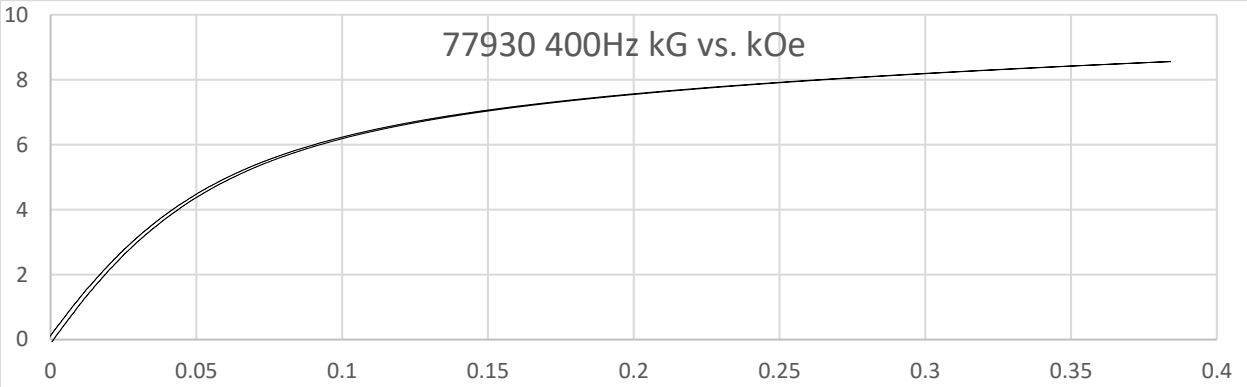
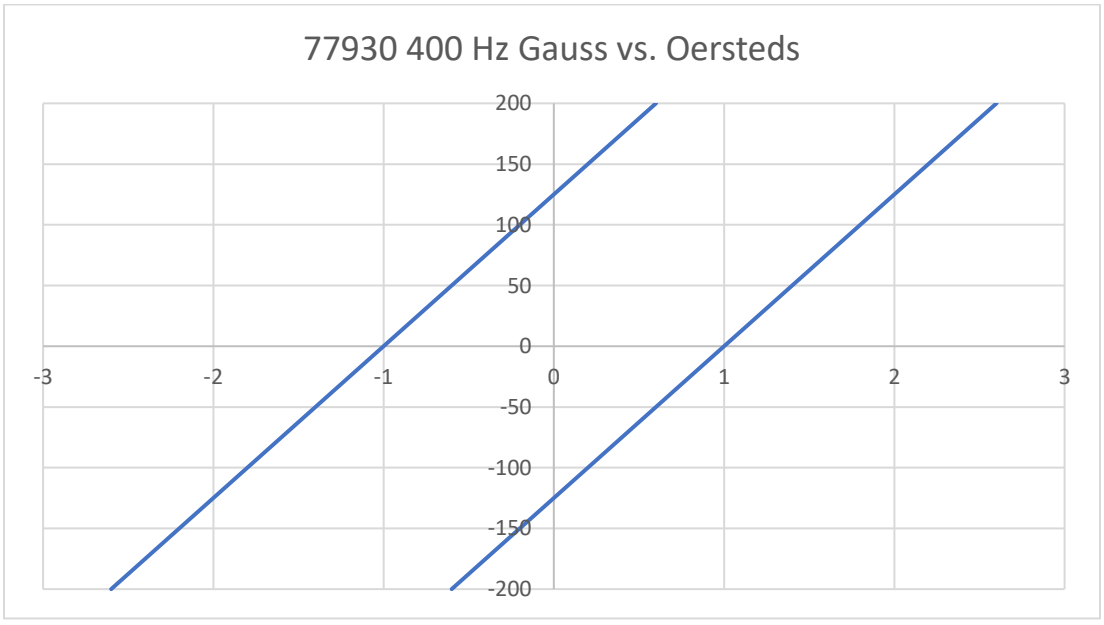
Powder Core Hysteresis Curves

BH loops for powder cores are very narrow and flattened due to the low material permeability and high supported currents. Consequently, the concepts of B_r (remanence) and H_c (coercive force) that are useful for other types of cores are not useful or even easily measured for powder cores. Jiles-Atherton coefficient models of ferrites and tapes wound cores depend on BH loop data points that are not applicable in the same way for powder cores.

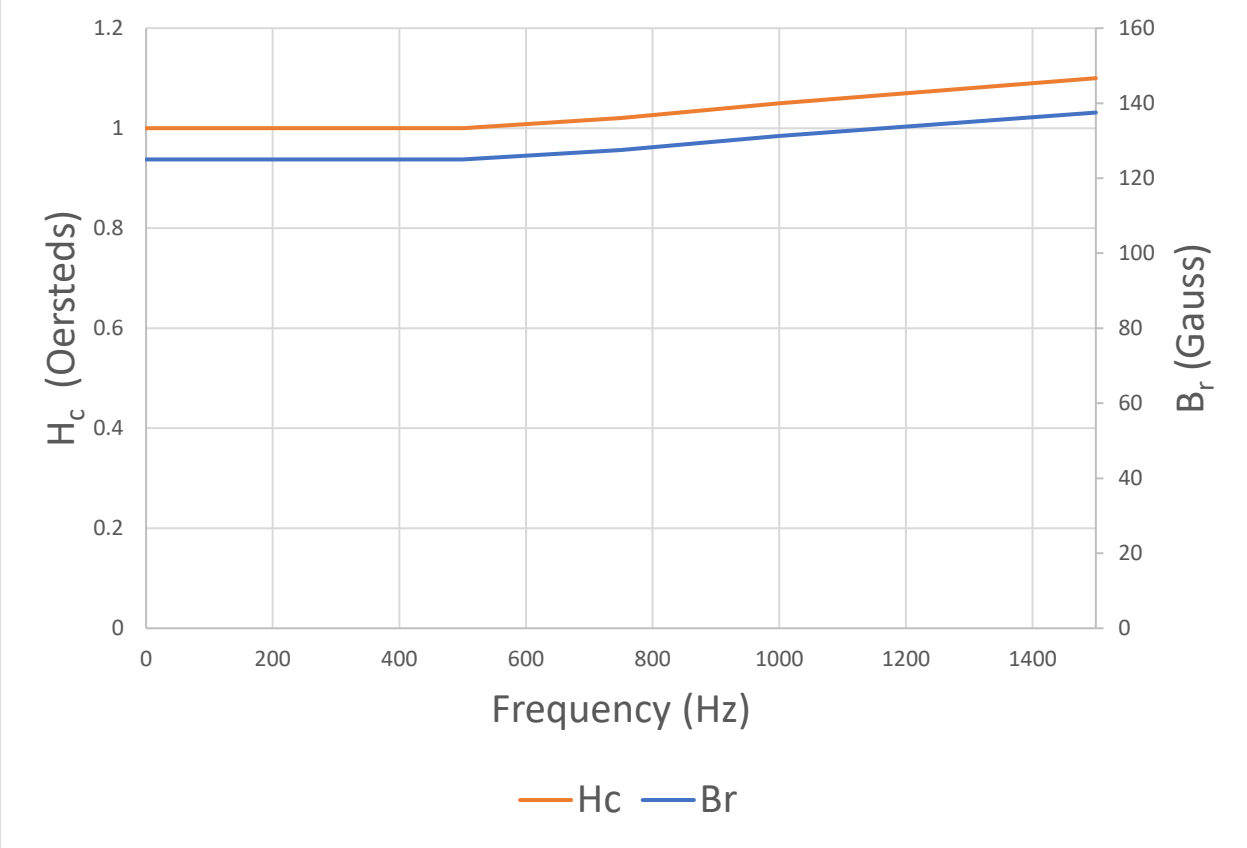
To illustrate, Magnetics plotted the BH curve for a standard 125µ Kool Mµ core, 77930-A7. The drive frequency for this curve is 400 Hz, since that is the lowest frequency that resulted in stable readings.



Zooming in on the area close to the origin, the remanence for this core is seen to be about 125 G (12.5 mT) and the measured coercive force is about 1 Oersted. Other powder cores will be similar, with B_r roughly proportional with permeability since the width of the loop does not change much for different permeabilities. Note that the exact value of B_r will have no practical impact on the permeability of the material, nor to its response to DC bias current. A difference among B_r values of, for example, 0 G, 125 G, and 500 G, would be indistinguishable in cores' impedance or load response.



As noted above, plotting a true DC BH loop plot is not practical. Nor is it necessary for a high frequency powder core material. To demonstrate that the 400 Hz BH loop is essentially the same as a DC loop, hysteresis curves were plotted for frequencies up to 1500 Hz, with the result that width of the hysteresis varies only very slightly, and it can be extrapolated to be nearly flat curve from 400 Hz to 0 Hz.



The data for the curves shown above is available by contacting Magnetics.