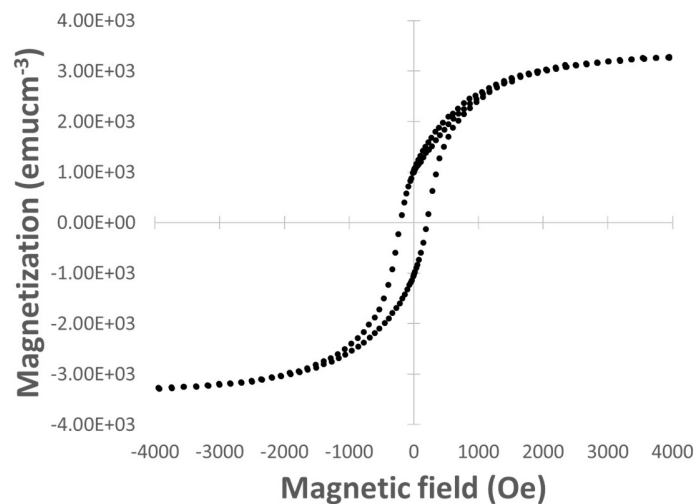


Strong Ferromagnetic Double Layer Structure for Handheld Electronics
Helsinki, Finland, December 10th, 2019. Reciprocal Engineering – RE Ltd. and the Center for Nanophase Materials Sciences at Oak Ridge National Laboratory researchers manufactured a strongly ferromagnetic double layer structure (FDLS). The FDLS structure possesses magnetization 30 times as high as the magnetization of $Y_3Fe_5O_{12}$ (YIG) - a classical ferrimagnetic insulator dominantly utilized in spintronic and microwave applications. The crucial feature of the FDLS – consisted of only three common elements – is the large remnant magnetization and the fact that no rare earth elements were utilized. The functional part of the structure is electrically insulating. Hysteresis measurements shown below confirm that the remnant magnetization value is large, i.e. FDLS is magnetized when the external magnetic field is zero.



Magnetization M versus magnetic field, measured from the 40 nm thick FDLS at 300 K. For comparison, the saturation magnetization commonly reported for YIG is $4\pi M=1750G=139\text{emucm}^{-3}$.

Advantages of FDLS in Technical Applications

Spin waves can be efficiently excited and processed by ferromagnetic insulators providing a platform for a rich set of information processing devices. FDLS can be applied in tunable radio-frequency and microwave devices, such as phase shifters and delay lines, magnetic field sensors, spin filters in spintronic devices and memory devices consisted of multilayer (stack) structures.

FDLS was grown from affordable elements whose flow can further be adjusted during the growth cycle so that several processing steps can be merged during multilayer device

manufacturing. Large remnant magnetization eliminates the need of external bias magnetic field thus making FDLS applicable in handheld electronic devices.

About Reciprocal Engineering – RE

Reciprocal Engineering – RE Oy is a Helsinki based company founded in 2017, which develops new sustainable magnetic thin film materials for semiconductor industry. European Union directives urge device manufacturers to consider the origin of raw materials and their environmental impact. Advanced materials provide a route to more efficient and significantly smaller electronics without compromising the environmental aspects. Patents are pending for several new thin film materials.

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