

Magnetic Compton scattering as spin-specific magnetic hysteresis measurement tool

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Introduction

Magnetic Compton scattering intensity reflects only the spin magnetic moment component of a magnetically active electron [1, 2]. This is a great advantage in investigating microscopic magnetic properties of materials, in particular spin-specific innate properties. In this study, we utilized the dependence of integrated intensity of magnetic Compton scattering of a thin film of amorphous TbCo on the applied magnetic field to obtain information on spin magnetization, *i.e.* the spin-specific magnetic hysteresis (SSMH) loop.

Experimental and Experimental procedure

A sample of a Tb₃₃Co₆₇ amorphous film was fabricated by the dc sputtering method with the thickness of 1 μm on Kapton film with the thickness of 12.8 μm.

The measurements were carried out at the AR-NE1A1 beamline. The experimental setup is illustrated in the left-hand side of Fig. 1.

The procedure to measure the magnetic effect in the range between -2 T and 2 T is shown in the right-hand side of Fig. 1. The sequence was controlled by a computer program. To measure the magnetic effect at H = X T, the highest magnetic field (1. H = 2 T) was first applied and then the target field (2. H = X T) was applied for measurement, and further, the lowest magnetic field (3. H = -2 T) was first applied and then the target field (4. H = -X T) was applied for measurement. The highest- and lowest- magnetic fields were applied to saturate the sample. Compton scattering intensity I^+ at H = X T and I^- at H = -X T measured to obtain the magnetic effect, which is in proportion to $(I^+ - I^-)/(I^+ + I^-)$, of H = X T. The data acquisition time was typically 60 sec and the process was repeated typically 120 times.

Results

Figure 2 shows the magnetic effect as function of external magnetic field. This is assumed as SSMH. The line shape is in good agreement with ordinal M-H hysteresis loop by VSM. We emphasize lastly that magnetic Compton scattering measurement will be adopted as a reliable tool to study magnetic material.

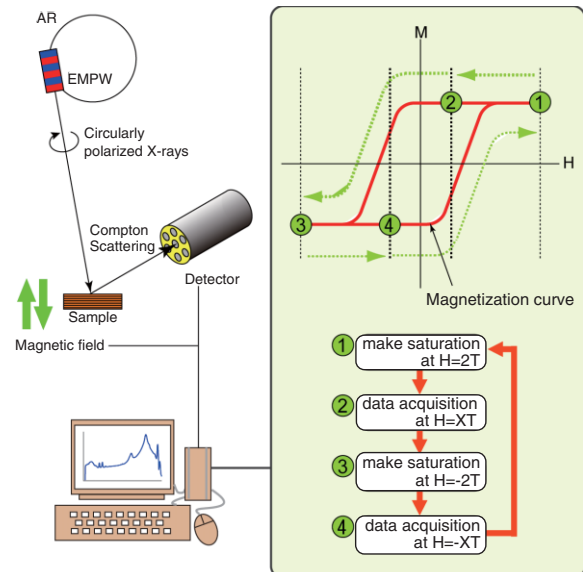


Fig. 1: Illustration of the experimental setup and procedure for measurement of the applied magnetic field dependence of integrated intensity of magnetic Compton scattering.

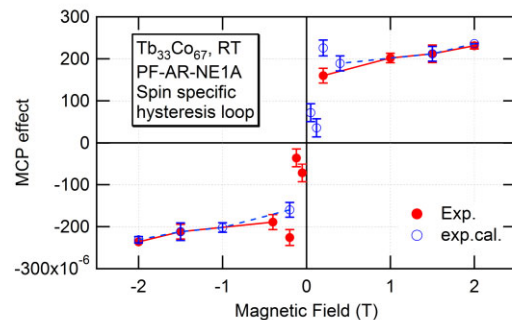


Fig. 2: The SSMH curve of Tb₃₃Co₆₇ amorphous film obtained by magnetic Compton scattering measurement. Red circles show the experimental result of measurement and blue circles are their inversion.

References

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