

Method for Simultaneously Measuring In- and Out-of-Plane Surface Magnetic Properties of Thin Films

Tech ID: 29522 / UC Case 2017-367-0

ABSTRACT

Researchers at the University of California, Davis have developed a method for measuring in-plane and out-of-plane surface magnetic properties of thin films.

FULL DESCRIPTION

In magnetized samples, a reflected light beam (due to interaction with a sample) differs in phase from the original beam. This non-reciprocal optical effect provides information about the sample's surface magnetic properties. Surface properties are currently measured using two configurations: one where light travels zero-area but is normally incident to the sample and the other where light travels a finite-area loop but at an oblique incidence angle. Both methods are required to measure in- and out-of-plane magnetic properties but must be measured separately as combining both into a single measurement gives rise to delayed echoes and degradation of the overall signal.

Researchers at the University of California Davis have developed a method which enables simultaneously oblique incidence and zero-loop area measurement configurations for sensitive detection of in- and out-of-plane magnetization. This method employs an optical configuration in which a single beam is split into two polarized beams that hit the magnetized sample at an oblique angle. The reflected beams then return to the beam source for recollection and phase analysis. Utilizing this oblique incidence allows for measurement of both in-plane and out-of-plane effects. Furthermore, reflection after light-sample interaction sends both polarized components back in such a manner that zero-area is enclosed in the loop traversed by the beam. This system allows for simultaneous oblique incidence and zero-loop area measurements while preventing delayed echoes and degradation of the signal.

APPLICATIONS

- ▶ Probing surface magnetic properties
- ▶ Characterization of thin films
- ▶ Characterization of magnetized samples

FEATURES/BENEFITS

- ▶ Oblique incidence and zero-area loop
- ▶ Simultaneous measurement of in-plane and out-of-plane magnetization

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,948,733	03/16/2021	2017-367

Additional Patent Pending

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INVENTORS

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OTHER INFORMATION

KEYWORDS

interferometry, non-reciprocal phase, non-symmetry phase, in-plane magnetization, out-of-plane magnetization, phase difference, light-material interaction, modulation, zero-area-loop, oblique incidence, single beam, magneto-optics

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Materials & Chemicals**

▶ Other

▶ **Sensors &
Instrumentation**

▶ Physical
Measurement

RELATED CASES

2017-367-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ [Methods and Apparatus of Measuring a Change in Thickness of an Object of Interest with Picometer Accuracy](#)

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