MAGNETIC FIELD IMAGING FOR DESCRIPTION OF MAGNETIC THIN FILMS USING NITROGEN VACANCY CENTERS IN DIAMOND CRYSTAL

Andris Berzins[1], Janis Smits[1], Arturs Smiltnieks[1], Marcis Auzinsh[1], Ruvin Ferber[1], Andrejs Cebers[2]

[1] Laser Centre, University of Latvia, Latvia
[2] Laboratory of Magnetic Soft Materials, University of Latvia, Latvia
andris.berzins@lu.lv

Nitrogen-vacancy (NV) centers in diamonds have proven to be useful for the imaging of magnetic fields created by various magnetic structures [1-3]. When a thin layer of NV centers is located close to the surface of a diamond, magnetic field distributions at the position of the NV layer can be imaged. We have constructed a magnetic field microscope and are using it to study field distributions created by magnetic structures in (and on) thin films made from different materials.

As an example of the measurements in Fig. 1. an optical image in combination with magnetic image can be seen. In the pictures one can see a surface of a thin film made from $(Cr_{0,5}Mn_{0,5})_2GaC$ with some defects on the surface. The strongly magnetic defects are Mn_5Ga_8 or Cr_5Ga_8, but the nonmagnetic defects are pure Gallium.

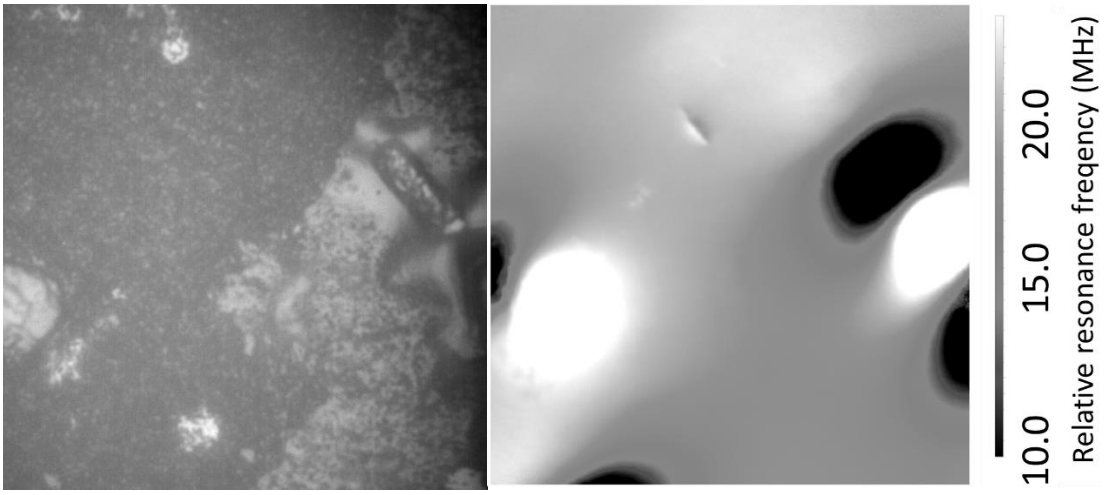

Fig. 1. On the left side – optical image, on the right – magnetic image. The color scale shows the relative resonance frequency of the optically detected magnetic resonance. The field of view is ~30x30 μm.

In perspective similar measurements will be done for imaging of magnetic phase transitions of thin films near liquid nitrogen temperatures. As the diamond is chemically, mechanically and temperature resistant the NV centers in diamond crystal has a great potential for characterization of magnetic thin film properties at different production phases.

A. Berzins acknowledges support from PostDoc Latvia project 1.1.1.2/VIAA/1/16/024 "Two-way research of thin-films and NV centres in diamond crystal" and LLC "MikroTik" donation, administered by the UoL foundation, for opportunity to improve experimental set-up. The Laser Centre group gratefully acknowledges support from Base/ Performance funding projects Y5-AZ27 and Y9-B013.

[1] J. Smits *et al*, Eur. Phys. J. Appl. Phys **73** 20701 (2016).
[2] L. M. Pham *et al*, New Journal of Physics **13** 045021 (2011).
[3] D. Le Sage *et al*, Nature **496** 486 (2013).