Magneto-Optics Properties of Graphite and Graphene.

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Faraday rotation is one of the most important magneto-optical phenomena and is used in spintronics research where is used to study the polarization of electron spins [1]. In this work we prepare thin graphite and graphene films in order to measure the Faraday rotation for both in the visible region of the spectrum order to compare it with theory [2]. We used two techniques to produce graphite thin films. Pulsed laser deposition using an excimer XeCl laser with an operating wavelength of 308 nm produced the best films. Films were also grown using spin coating, but this produced poor quality films that appeared dark. Graphene thin films were prepared by using low pressure chemical vapour deposition. The magneto-optic spectrum is measured using the method of Sato [3] during which the magnetic circular dichroism MCD is measured simultaneously with the Faraday rotation. There are no available calculations of the MCD for graphite and graphene.A xenon lamp (150W), with an energy range of (1.5-4.5 eV) been used for our measurements and an electromagnet with an attainable maximum field of 1.8T. The magnetic field is perpendicular to the plane of the sample and parallel to the direction of incidence. A Dektak surface profiler is employed in order to measure the samples thickness. In addition, the thicknessesof the films have been estimated from the optical absorption using parameters taken from the bulk, by taking account of the reflections from the front and back sides of the film[4]. Both measurements showed that the thickness is dependent on the deposition time. The surface topography and the structural changes of the graphite films were characterized by scanning electron microscopy (SEM), and AFM scanning probe microscopy. The SEM measurements show a flat surface topography, however a height variation of (±5nm) was detected by AFM for a film of thickness approximately (20nm) Figure 1.The XRD for thin graphite and graphene films will be presented [5].Results for the Faraday rotation and MCD in the range 1.5eV to 4.5eV will be presented and compared with the theory.

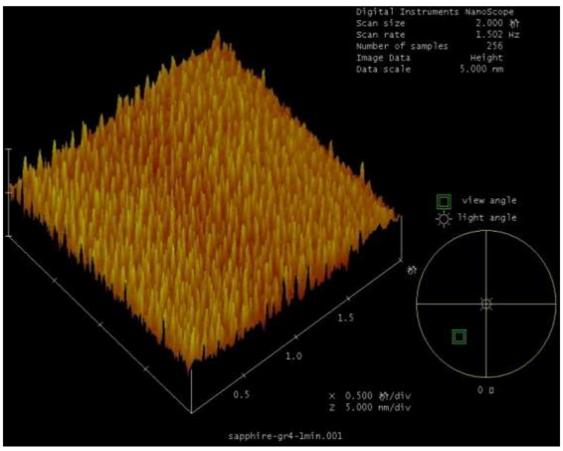

Figure 2: AFM for Graphite (1min)

[1] A. Zarifi, ISRN Condensed Matter Physics, 2013(2013) 843702. [2] T.G. Pedersen, Physical Review B, 68 (2003) 245104. [3] K. Sato, Japanese Journal of Applied Physics, 20 (1981) 2403-2409. [4] G.E. Jellison, Jr., J.D. Hunn, and Ho Nyung Lee, Physical Review B, 76(2007) 085125. [5] L. Tang, Y. Wang, Yueming Li, H. Feng, Jin Lu, and Jinghong Li, Advanced Functional Materials, 19(2009) 2782-2789.