

Announcing the Final Examination of Hussain Abouelkhair for the Degree of Doctor of Philosophy in Physics

Date: Monday, October 16, 2017

Time: 10:00 a.m.

Room: PSB 445 (Physical science building)

Dissertation title: Growth and Doping of MoS₂ Thin Films for Electronic and Optoelectronic Applications

Abstract:

MoS₂ high absorption coefficient, high mobility, mechanical flexibility, and chemical inertness is very promising for many electronic and optoelectronic applications. The growth of high-quality MoS₂ by a scalable and doping compatible method is still lacking. Therefore, the suitable dopants for MoS₂ are not fully explored yet. This dissertation consists mainly of four main studies.

The first study is on the growth of MoS₂ thin films by atmospheric pressure chemical vapor deposition (APCVD). Scanning electron microscope images of these films revealed the growth of randomly distributed microdomes of MoS₂ on top of a smooth MoS₂ film. These microdomes are very promising as a broadband omnidirectional light trap for light harvesting applications. The aim of the second study is to grow MoS₂ thin films by low-pressure chemical vapor deposition (LPCVD) using a doping compatible process. Control of sulfur vapor flow is essential for the growth of a pure phase of MoS₂. Turning off sulfur vapor flow during the cooling cycle at 700 °C leads to the growth of highly textured MoS₂ with a Hall mobility of 20 cm²/Vs.

The third study is on the growth of Ti-doped MoS₂ thin films by LPCVD. The successful doping is confirmed by Hall effect measurement and secondary ion mass spectrometry (SIMS). Different growth temperatures from 1000 to 700 °C were studied. Ti acts as a donor in MoS₂. The fourth study is on fluorine-doped SnO₂ (FTO) which has many technological applications including solar cells and transistors. FTO was grown by an aqueous-spray-based method. The main objective was to compare the actual against the nominal concentration of fluorine using SIMS. The achieved fluorine concentration is proportional to the amount added to the solution but lower by a factor of ~30.

Outline of Studies:

Major: Physics

Educational Career:

M. S. Ain Shams University, Egypt, 2010

B. S. Helwan University, Egypt, 2005

Committee in Charge:

Dr. Robert Peale (Chair)

Dr. Sergey Stolbov

Dr. William Kaden

Dr. Kevin Coffey (External Committee Member)

Approved for distribution by Dr. Robert Peale, Committee Chair, on October 03, 2017.

The public is welcome to attend.