Contribution ID: **174** Type: **Poster Presentation**

Proton beam and femtosecond laser writing lithography method for semiconductor microstructures

Tuesday, 4 July 2023 17:09 (20 minutes)

We herein report on the fabrication of patterns using proton beam writing (PBW) and femtosecond laser lithography. In femtosecond laser lithography, high-resolution patterns can be created on semiconductor materials using the energetic photons from a laser source as it has been done for the fabrication of microfluidic lab on chip photonic devices and biochips applications. In the pattern fabrication for this study, a femtosecond laser with a wavelength of 1034 nm, a repetition rate of 200 kHz, and a pulse duration of 190 fs will be used. The structures will be created using pre-programmed in the X-Y stage controller software.On the other hand, PBW uses focused high-energy beams of protons to probe the material to fabricate patterns or structures at the micro- and nanoscale. This will be achieved using a 3MV Tandetron accelerator at iThemba LABS, proton beam focusing is achieved by using Oxford triplet quadrupole lenses and scanning uses an electrostatic scanning system positioned in front of the lenses. In contrast to femtosecond laser writing, PBW tends to have a deeper penetration into the target material due to the higher energy of the protons, which leads to three-dimensional structures with higher sub-micrometer precision. Patterns were created on a PMMA using 3 MeV protons and the fluence was counted as electrical charge per unit monitored by exposure time, beam current, and irradiated area. A Femtosecond laser was also used to fabricate the cross-like patterns from pre-programmed patterns by focusing a laser pulse onto PMMA for comparison. The morphological and microstructural characterization of the samples was conducted using scanning electron microscopy (SEM) and atomic force microscopy (AFM). The fabricated cross-like patterns will be used in a study of low-temperature Hall bar measurements for device fabrication.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

Consent on use of personal information: Abstract Submission

Primary author: Mr GUGA, Aluwani (University of Cape Town)

Co-authors: Dr KOTSEDI, Chester (iThemba Labs); Prof. BLUMENTHAL , Mark (University of Cape Town); Dr MONGWAKETSI, Nametso (iThemba Labs)

Presenter: Mr GUGA, Aluwani (University of Cape Town)

Session Classification: Poster Session 1

Track Classification: Track A - Physics of Condensed Matter and Materials