Modelling of Overlapping Ion Tracks Structure in Solids

A. B. Demchyshyn[1] **and P. O. Selyshchev**[2]

Abstract: As a result of irradiation with Xe with E = 250 MeV in InP at room temperature [1] defects, similar to the "chain of pearls", which are placed along the trajectory of the ions at depths ranging from 35 to 100 nm and from 7 to 10 microns have been identified. Such defects called tracks, and they can occur at different depths and have different shapes.

Formation of extensive structures from separate tracks depending on the characteristics of the projectile beam and on parameters of the swift heavy ions(SHI) induced tracks were theoretically modeled in my work.

Tracks were examined like a chain of deal spherical regions; it was assumed that each incident ion creates one such chain. In this model, we assume that the track is formed randomly, but in that place of the ion path, where the energy value, which loses each ion to the unity of the way, is above some threshold value. The dependence of the surface area of the sample after exposure and removal of the modified substance from the irradiation dose, and the incidence beam angle of heavy swift ions and from the average distance between the one tracks spherical parts was search out. Calculations were made using Monte Carlo method.

As a result of irradiation the number of tracks will continue to grow, areas of the single tracks modified substance continue to overlap, form of modificated matter becomes more complicated, creating branched structure.

Percolation threshold, fraction of spanning cluster modified material for different doses and different distributions of track areas in depth were evaluated. Based on the scaling hypothesis large-scale curve were constructed, critical exponents for this percolation model were established.

Calculated values of critical exponents were compared with the known values for the model of continuous percolation. Parameters of the percolation and critical exponents depend on the distribution of track areas in depth, which indicates the difference in the order parameters of the track structure obtained for different distributions in depth.

[1] Faculty of Physics
Taras Shevchenko National University of Kyiv
03187, Kyiv, Ukraine
dem_and@i.ua

[2] Department of Physics
University of Pretoria
Private bag X20 Hatfield 0028, Pretoria, South Africa
selyshchev@gmail.com