# Abstract

A pure germanium single crystal (i-Ge) with dimensions (2 x 3 $cm^2$), orientation (111) and thickness (0.51mm) that was used in this work, it have been cut into a small samples, irradiate by Nd: YAG laser with wavelength (1064 and 532 nm), of different energies (20, 40, and 60 mJ) with different number of pulses (5, 10, and 20), and spot size 1.5 mm, and pulse duration 10 ns. Each sample irradiated with a specific parameters then they were tested using the Atomic Force Microscope (AFM) to measure the diameters and the heights of the nanostructures that formed on the surface of each sample. The optical energy gap $E_g$ after the irradiation was estimated by using the Fluorescence Spectrophotometer to find the difference with the pervious energy gap (energy gap of germanium $E^o_g$= 0.66 eV at 300 k). Increasing the number of pulses decreased the diameters and the heights of the nanostructures for each energy, which is caused to decrease the size of the nanostructures, also it was found that the energy gap increased compare to the previous energy. The optimum results was shown in wavelength 532 nm because the energy in this case is twice of the original energy. This process is used in detectors formation to increase the enhancement of surface active area.