CREATING NANOPOROUS GRAPHENE WITH SWIFT HEAVY IONS

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We simulate using a two temperature MD code the damage induced by swift heavy ions in a free-standing graphene layer and compare the results with the data from Raman mapping. The experiment shows that for stopping powers over the defect threshold 1.3 KeV/nm the defects increase with the stopping power. Stopping powers under the threshold show fewer defects and suggest a purification of graphene through annealing.

We couple the electronic subsystem to the MD lattice through an electron-phonon coupling and solve recursively the heat equations for the coupled system. We reduce the number of free parameters required by the model and obtain the electronic heat capacity and the electron phonon coupling for different doping levels from first principle calculations. The only fitting parameter is the electronic thermal conductivity, we analyze its effect on the threshold stopping power at which structural defects appear, these defects are measured with Raman spectroscopy.

We observe in our simulations that the radius of the damaged area grows with the stopping power above the threshold value and that the defect formation shows low dependence on the doping level. We compare the simulation results with the experimental data and report a correlation between the size of the damaged area and the defects observed with Raman mapping.