Supplementary information

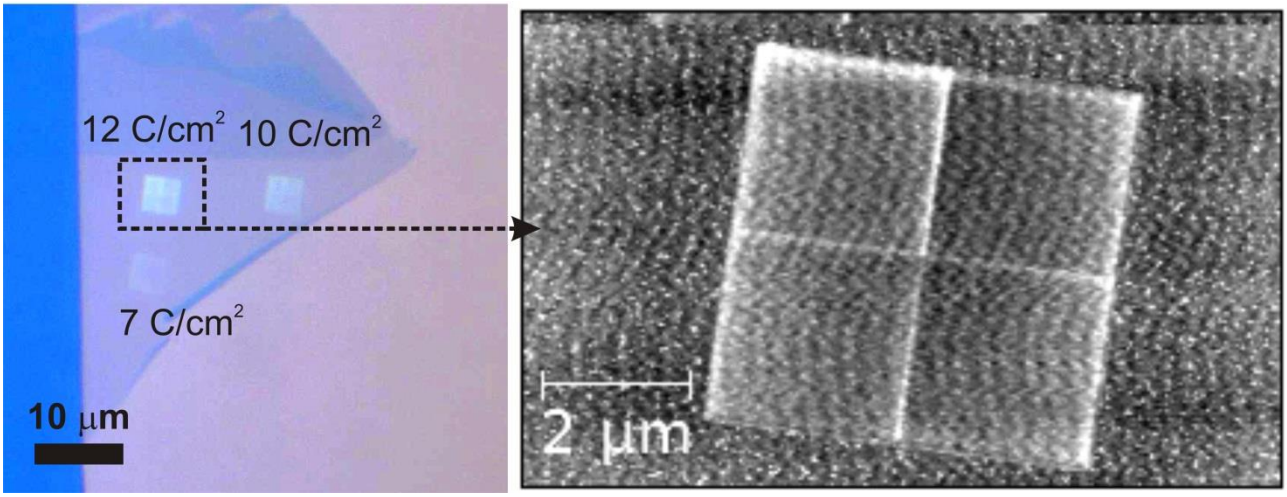

Figure 1S. (a) Optical image of 3 squares written at different doses on single layer graphene. The intensity of the blue halo, due to the deposition of amorphous carbon, is correlated with the dose. (b) Atomic Force Microscope image of the 4x4 μm square directly written on graphene with a dose of 12 C/Cm^2. The ridges indicate how the EBL software divides the square in 2x2 μm polygons.

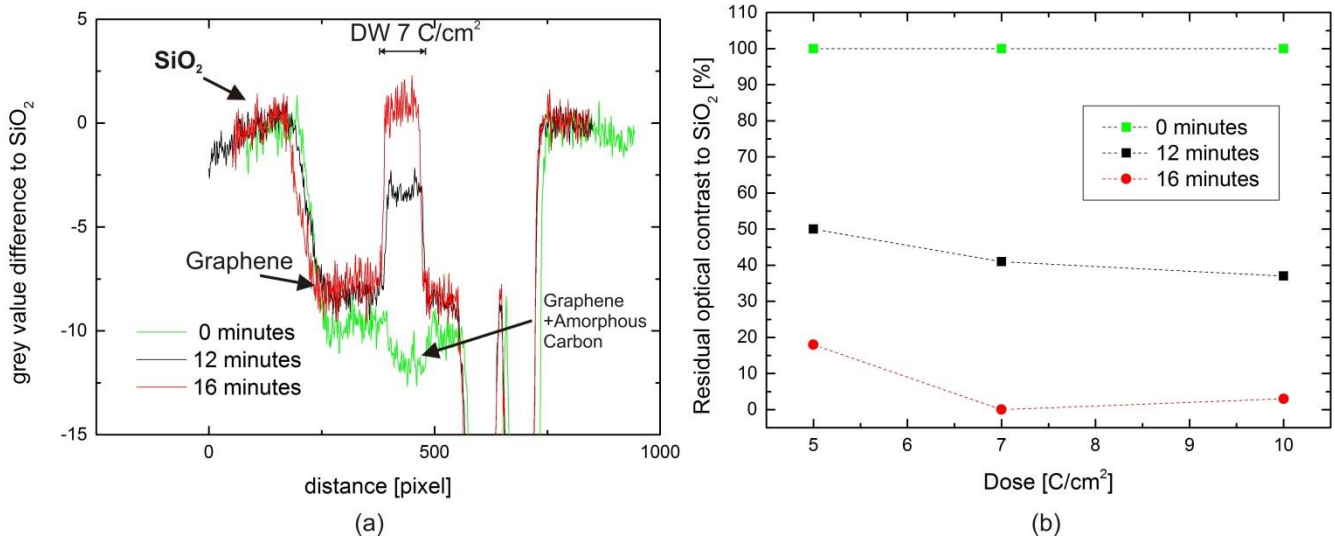

Figure 2S. (a) Evolution of the optical grey value profiles of the square written with 7 C/cm^2 in Figure 3c as the etching proceeds. The profile is a cross section along the graphene flake. (b) Evolution of the optical contrast of the squares in Figure 3c as the etching proceeds.

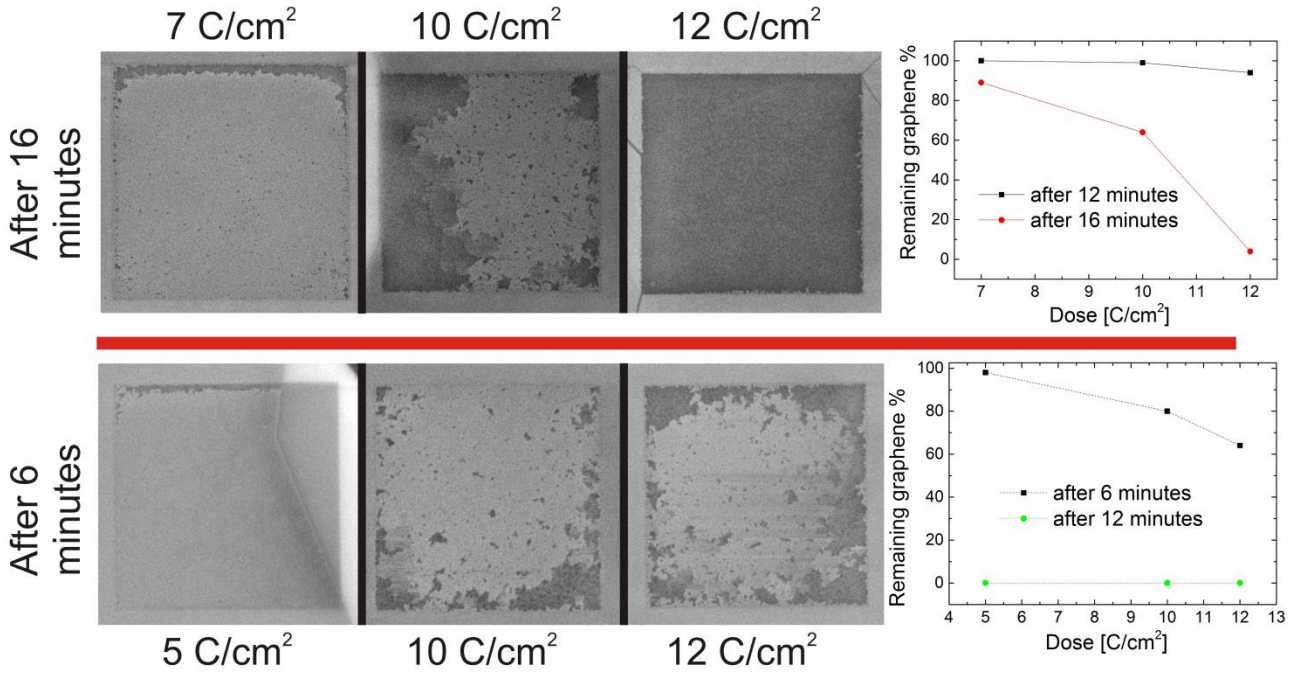

Figure 3S. Two different single layer graphene samples each with square patterns. The two samples were etched for 6 and 16 minutes, respectively. We attribute the different etching speed to the fact that the two samples were not etched simultaneously and small differences in the temperature or position could result in large variations of the oxidation rate. The graphs on the right show the amount of remaining graphene as a function of the dose and time for the two samples. As expected the higher is the dose the lower is the remaining graphene inside the written squares.

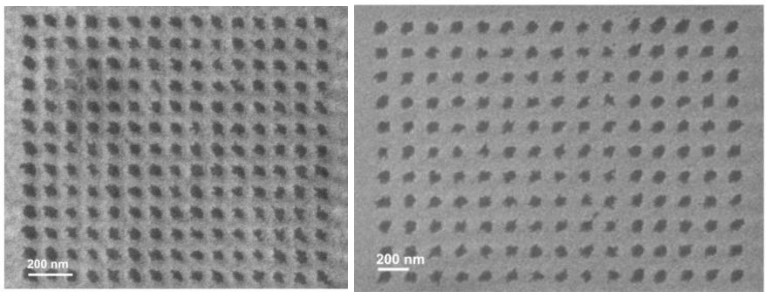

Figure 4S. SEM images of two arrays of nanoholes written with 12 C/Cm^2 and etched for 16 minutes at 435 ^{o}C. The minimum pitch achieved is 100 nm and the minimum diameter is 40±7nm.

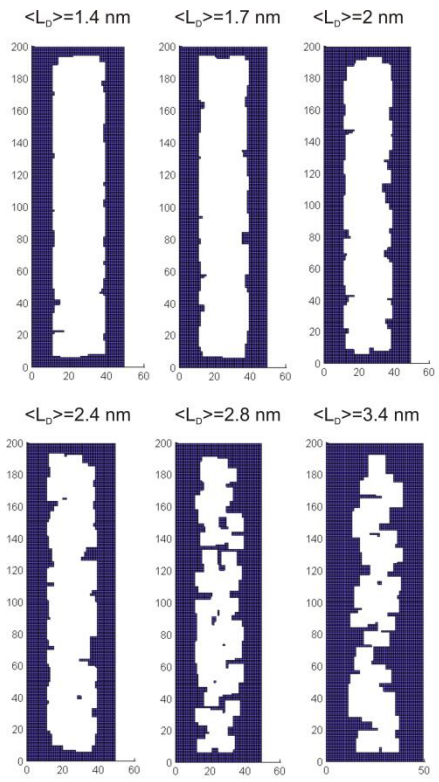

Figure 5S. 2D Simulations of the evolution of the edge roughness as a function of the initial defect density <L_D>. The simulations are all stopped after 5 iterations. The higher is the defect density (the lower is <L_D>) the smoother are the edges.