Bistable states of 5-7 defects in graphene

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Defects of a graphene sheet of a 5-7 type are considered, when instead of hexagons the 5- and 7-gons are present while dangling C–C bonds (radicals) are absent. Defects in graphene were experimentally found and an increase in density of π-electron states in the vicinity of such defects was mentioned in [1].
The block-regular method, developed by the authors [2], allows calculation of 5-7 defects employing methods of differential geometry and topology for description of the properties of carbon surfaces containing such defects. It was previously shown (see, e.g., [3]) that in the graphene sheet the 5-7 defect being the convexity of the carbon hexagonal lattice leads to the redistribution of π-electron charges and to the appearance of the local electric dipole moment. There is a possibility of the 5-7 defect turning inside out (inversion relative to the graphene plane) by using the external electric field, which leads to the change in a direction of the electric dipole. Moreover, the graphene plane with the defects of convexity (or concavity) type can be formed on an engineering surface (matrix) which contains convexities and concavities of nanometer size in both vertical and in-plane directions.

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Effect of annealing and biaxial deformation on the dielectric properties of composites of multiwall carbon nanotubes and poly(ethylene terephthalate)

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The dielectric properties of composites of PET with MWCNTs were investigated over a wide frequency and temperature range below the electrical percolation threshold. In composites with 1 wt% MWCNT inclusions the dielectric properties below room temperature are mostly determined by β relaxation, as a consequence of the rotation of PET molecules. In bi-axially stretched samples the CNTs are oriented at about 45o to the stretch direction. Such deformation increased the potential for molecular rotation. However, annealing after stretching increased homogeneity of the composite and decreased the potential barrier for polymer chain rotation. Electrical conductivity effects and Maxwell–Wagner polarization mostly cause the dielectric properties of the samples with 2 wt% MWCNT inclusions. The potential barrier for carrier tunnelling is lowest in the annealed sample.

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