TERAHERTZ RADIATION ABSORPTION BY THE COMPOSITES CONTAINING CHEMICALLY MODIFIED CARBON NANOTUBES

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For terahertz applications composites containing metallic CNTs (m-CNTs) only are preferred as the semiconducting CNTs (s-CNTs) weakly interact with the terahertz radiation. However, creation of such a homogeneous composite is a challenging task and most composites contain mixture of m-CNTs and s-CNTs. In this communication we theoretically demonstrate that terahertz conductivity of the composite containing mixture of m-CNTs and s-CNTs could be substantially enhanced by the chemical modification of the CNTs in composites by the boron and nitrogen atoms (Fig. 1). This improvement is due to the fact that electronic properties of CNTs and the corresponding plasmon effects are affected significantly by the type and degree of doping. In particular the rise of the charge carriers density at the Fermi level (electrons in the case of nitrogen substitution and holes in the case of boron doping) leads to the metallization of semiconducting SWNTs.

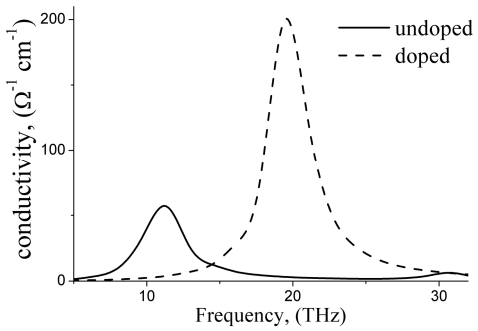

Fig. 1. Real part of the conductivity of the composite comprising randomly oriented identical CNTs bundles of length 300 nm before (solid line) and after (dashed line) the CNT doping by nitrogen. Each bundle contains 7 SWNTs: 3 x (13,0) – 2 x (12,0) – 2 x (11,0). Volume fraction of bundle in composite is 0.5%. Doped bundles contain 2% of nitrogen impurities.