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Nanotubes in polar environments: Solvated charge carriers and their dynamics GEOFFREY USSERY, YURI GARTSTEIN, Dept. of Physics, Univ. of Texas at Dallas, Richardson, TX, USA — Excess charge carriers on semiconducting nanotubes immersed in sluggish polar environments (such as common solvents) can undergo self-localization into polaronic states whose properties are profoundly different from the free band states. We explore such solvated states within the adiabatic continuum framework using a simplified picture of an electron or a hole confined to a cylindrical surface in the 3D polar medium. At the static level, the binding energy of a polaron is evaluated and found to be a sizable fraction (~ 0.3) of the corresponding Wannier- Mott exciton binding energy, which is expected to substantially decrease the thermal activation energy for the exciton dissociation. We discuss the diffusion and mobility of polarons caused by the dielectric fluctuations of the medium and applied electric fields, as well as the local dielectric relaxation modes in the vicinity of the polaron. We also discuss the electronic (optical) transitions between the localized electronic states within a self-consistent potential well due to the orientational polarization pattern.
[1] Yu.N. Gartstein, Phys. Lett. A 349, 377 (2006).
[2] Yu.N. Gartstein, T.D. Bustamante, S. Ortega Castillo, J. Phys.: Cond. Matter 17, 156210 (2007).

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