On the constitutive assumptions for the recombination term for the R-D-D equations for scintillators

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Abstract

The evolution equations for inorganic scintillators (which converts ionizing radiations into visible light) were obtained in previous papers: they are Reaction-Diffusion-Drift equations, coupled with the Poisson equation of electrostatics and Neumann boundary conditions, in terms of the m-dimensional charge carriers vector. These equations were obtained by the means of a microstructured continuum model where the rate-of-change of the director is identified with the scintillation potential. Here we shall deal with various constitutive assumptions for the recombination term and show how, when we choose is the Gibbs-Boltzmann entropy, we can recover the cubic polynomial expression used in one of the few previous existing phenomenological models. Further we shall show how a polynomial representation can be obtained as a limit of a Markov process and also explore the instance in which the entropic term is represented instead by the Fermi-Dirac potentials.

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