# Abstract for the EMRS-spring meeting 2005

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INCLUDING EXCITONS IN SEMICONDUCTOR SOLAR CELL MODELLING, Marc Burgelman and Ben Minnaert, University of Gent, Electronics and Information Systems (ELIS), Pietersnieuwstraat 41, B-9000 Gent, Belgium

Excitons are marginally important in classical semiconductor device physics, and their treatment is not included in standard solar cell modelling. However, in organic semiconductors and solar cells, the role of excitons is essential, as the primary effect of light absorption is exciton generation, and free electrons and holes are created by exciton dissociation. First steps to include excitons in solar cell modelling were presented by Green 1996 and Zhang 1998. Their model was restricted to an analytic treatment of the neutral p-region of a one sided n+p junction, and uniform exciton dissociation and recombination was considered only in the p-bulk. We now extended this model to also include the space charge region (SCL), and exciton surface dissociation and recombination at the contacts, or non-uniform bulk dissociation (e.g. field enhanced dissociation in the SCL). As we assume a preset hole concentration throughout, and electric field in the SCL, our model is still not general, but it covers most real semiconductor situations. The model leads to two coupled non-linear differential equations, which are solved numerically. A first result is that it is possible to apply the standard semiconductor device modelling frame to situations were excitons are dominant. In particular, normal solar cell behaviour is calculated when there is only exciton (and no free eh) generation, and when exciton dissociation is only at a contact surface, or only in the SCL. Further exploration of our model is necessary to cover also situations and parameters relevant for organic solar cells.