Calculation of defect capture cross section in Si and GaN with multi-phonon processes

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Hot electron capture by defects in semiconductors is a multiphonon process, in which electrons from the conduction band transition to a localized defect state by releasing energy to phonons. In our work, we consider the capture cross section arising from two parts: a zeroth order contribution from the Franck-Condon approximation and a first-order contribution as the result of electron-phonon coupling. We propose a method that enables the calculation of the muti-phonon contribution to electron capture. We apply the method to Si with hydrogenated vacancies and GaN with C substitution on nitrogen sites, respectively.