**Appendix 1: Product formation formulation**

Although the product formation rate (inverse of product formation time) is different in different regions (G, A or GGG), the probability density function (|ψ|2) will decay at a rate depending on the overall product formation rate of the whole structure. Let the average time constant for product formation is τC, then the product formation rate for different regions should be proportional to the probability of existence of hole (includes hole formation and decay) in that region and inversely proportional to the product formation time. Hence,

dPG/dt = B αG exp(-t/τC)/τGC …. (A8)

dPA/dt = B αA exp(-t/τC)/ τAC ….. (A9)

dPGGG/dt = B αGGG exp(-t/τC) /τGGGC ….. (A10)

Here, PX represents the probability of product formation, αX is the probability of hole formation, i.e., integral of the normalized wavefunction|ψ|2, τXC is the reaction time in any region X, where X= G, A or GGG, and B is a proportionality constant that takes into account the probability of existence of the wave function in the energy state under consideration. The expected value of τC can be calculated by taking weighted average of the reaction rates in different regions

1/ τC = αG/ τGC + αA/ τAC + αGGG/ τGGGC ……….(A11)

It may be mentioned here that αG + αA + αGGG = 1 (as normalized wavefunction is used)

Let τ be the expected life time of the wave function (due to inelastic scattering). Then the probability of product formation PX can be obtained by integrating the eq.A8 to A10 over a time period of 0 to τ. The final result after integration is given by

PG = B αG τC (1- exp(-τ/τC))/τGC …. (A12)

PA = B αA τC (1-exp(-τ/τC))/τAC ….. (A13)

PGGG = B αGGG τC (1-exp(-τ/τC))/τGGGC ….. (A14)