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Electronic Energy States in Nano Particles

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An electron in the conduction band of a particle is nearly free to move inside the particle and this situation can be pictured as an “Electron inside a finite depth potential well”. The energy equations for this system can be derived by applying the “Time Independent Schrödinger equation” and corresponding boundary conditions in terms of one and three dimensions.

In this study we have employed computer software and numerical root finding methods to obtain the numerical values of the legitimate energy states as it is more reliable than the conventional graphical methods. According to these numerical solutions, we could demonstrate that the number of allowed energy states and the spacing between adjacent levels inside a nano particle depend on both particle size and the magnitude of the attractive potential. Further, “Quantum tunneling effect” is significant when the particle size is below 20 nm and lowering the magnitude of the attractive potential, would extend the wave function far beyond its boundary. The energy levels obtained by employing the computer software and numerical root finding methods to the energy equation were plotted and compared with reported experimental observations and they are in good agreement. The most interesting size dependent property related to the semiconducting nano particles is that, we can obtain every colour of the visible spectrum by changing the size within the nano range, while the composition is unchanged.