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# Analysis of Photoluminescence measurement data from interdiffused Quantum Wells by Real coded Quantum inspired Evolutionary Algorithm

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Reliable analysis of any experimental data is always difficult due to the presence of noise and other types of errors. This paper analyzes data obtained from photoluminescence measurement, after the annealing of interdiffused Quantum Well Hetrostructures, by a recently proposed Real coded Quantum inspired Evolutionary Algorithm (RQiEA). The proposed algorithm directly measures interdiffusion parameters without using Arrhenius plot. Further, the results obtained are better than those with Genetic Algorithm and Least Square Method. The RQiEA is better suited than other state of art techniques of data analysis as it uses real coding rather than binary coding and its search process is inspired by quantum computing. It has also reliably detected extrinsic interdiffusion process.
Photoluminescence is a widely used process for measurement of interdiffusion parameters in semiconductor quantum well heterostructures. This method correlates the changes of the confined energy levels (PL peak energy) into characteristic diffusion length (LD) of the quantum well structure by a linear theoretical model. The correlated LD2 is plotted against annealing time, t, to determine the interdiffusion coefficient, D (T), by using the following equation:
LD2 = 4*D(T)*t

The interdiffusion parameters viz., activation energy, Ea, and the interdiffusion prefactor, Do, are determined by using Arrhenius equation:
D(T) = Do *exp(-Ea/(K*T))
Where K is Boltzmann Constant and T is annealing temperature in Kelvin.

Evolutionary Algorithm (EA) mimics process of natural evolution. RQiEA has been designed by integrating superposition and entanglement ideas from quantum computing in EA. It uses adaptive quantum inspired rotation gates to evolve population qubits. It has been shown that QiEAs are more powerful than EAs as they can better balance Exploration and Exploitation during search process.

## Summary

Reliable analysis of any experimental data is always difficult due to the presence of noise and other types of errors. This paper analyzes data obtained from photoluminescence measurement, after the annealing of interdiffused Quantum Well Hetrostructures, by a recently proposed Real coded Quantum inspired Evolutionary Algorithm (RQiEA). The results obtained are better than those with Genetic Algorithm and Least Square Method.

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