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Quantum mechenical modelling of photon density dependent light matter interaction and it applicatin in laser power dependent raman studies

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The quantitative understanding of laser power mediated changes on the Raman peak profile has been treated quantum mechanically, for this purpose we consider the interference between the electronic continuum due to Urbach tail states and the discrete phonon modes. The temperature effects are introduced considering perturbation term within the Fröhlich Hamiltonian which clearly accounts for enhance electron phonon coupling (EPC) in semiconductors with temperature of a form ; 1/q ~ EPC is a Fano asymmetry parameter. This theoretical model has been verified on the experimental results of laser power dependent Raman spectra of bulk EuFeO3, TiO2 and Silicon nanowires, and are in good agreement. Furthermore it is concluted that the observed enhanced EPC relates the local thermal disorder due to the laser induced heating in the sample that increases electronic disorder in the form of Urbach energy (EU), thereby promoting finite population of electrons to the continuum i.e., Urbach tail states. Those electrons lying just above the Fermi level interfere with the discrete phonons giving rise to Fano resonance. Thus, the present studies provide an quantitative understanding of the laser induced effects in the Raman spectra of bulk and nanowire semiconductors with implication across all length scales i.e. from zero dimension to bulk.

Biography

Pankaj R. Sagdeo has completed his PhD from UGC-DAE-CSR, DAVV Indore, India and postdoctoral studies at VBS/XPS beamline Indus-1 synchrotron radiation source, RRCAT, Indore India. He is presently serving as the Head, Department of Physics, Indian Institute of Technology Indore-India and earlier served as Head of Material Science and Engineering, Indian Institute of Technology Indore-India. He has published more than 125 papers in reputed journals and has been serving as referee for various reputed journals published by AIP, IOP, Elsevier, Springer, Wiley, MRS and many more.