Current research:

i. Metal nitrides of aluminum, gallium, scandium, and yttrium are class of nitrides semiconductor with interesting mechanical, electronic and optical properties. Their combinations with rare-earth metals in the form of dopants, open possibilities for material heterostructures for wide range of applications. Hence, we are studying the intrinsic defect and dopant interactions in rare-earth doped metal nitrides using both experimental and computational approaches.

   We have computationally investigated the structural, electronic, optical, vibrational, mechanical and elastic properties of polymorphs of nitrides of aluminum, gallium, scandium and Yttrium. These form the foundation for the study of defect properties which is crucial to achieving the overall objective of the study.

   Also, we have synthesized doped nitrides samples but are still working on the determination of the lattice location and the concentration of dopants in the samples. From application point of view, the study has the potentials to discover new class of material suitable for applications in optoelectronics, quantum information processing and information storage as well as materials for renewable energy.

ii. The increasing use of ternary and multicomponent alloys systems in the electronic industries explains why we are interested in the study of thermodynamic properties of ternary and multicomponent alloys. At present, preliminary calculations have been done on the concentration-concentration fluctuations in the long wavelength limit and short range order of some ternary alloys. The study is being extended to multicomponent systems. It is expected that at the end of this study, the results obtained will provide additional information on the structure of both ternary and multicomponent alloys and consequently shed more light on the relevance of these systems in the electronic industries, especially as possible substitutes for lead-free solders.