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An appropriate quantum mechanical approach to understand the anomalous behaviors of liquid alkali metals and group-IV alloys

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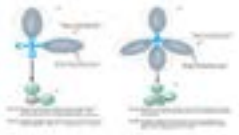
The anomalous properties of liquid alloys of alkali metals with group III, IV,V and VI elements (post transition metals or semi metals), particularly alkali metals and group-IV (usually Pb and Sn) alloys at and around the stoichiometric compositions have tempted internationally to thrust research works in these materials for the last three and half decades. The observed peculiar properties i.e. departure from ideality in the structure, thermodynamic and other related properties in these systems have been attempted to explain with the hypothesis of the existence of polyanions i.e., zintl ions such as $(Pb_4)^{4-}$, $(Sn_4)^{4-}$ and $(Te_2)^{2-}$ etc. But, the existence of these ions or complex compounds is not experimentally confirmed and some of the observed phenomena are also self-contradictory to the basis of zintl principle. Hence, concluded as paradox by many authors. So, a new bonding scheme of loose overlapping of the atomic orbitals is introduced to tackle this paradox. Hence, a significant amount of effective charge transfer takes place between the atoms in the stoichiometric compositions. The chemical short range order (CSRO) in these alloys has been explained by coulomb interaction in lieu of zintl hypothesis. The generalized models for structure and thermodynamics of charged –hard-spheres mixture of arbitrary charge and size has been developed through sustain efforts of decades' research. These models are employed successfully to evaluate the structure and thermodynamic properties i.e., entropies and entropies of mixing etc., treating the samples as partially charge transferred systems. Thus, internationally proclaimed paradox has been resolved. Some of the excellent research outcomes, achievements of my decades' struggle along with the future plan would be delivered in this invited speech.



Biography

Alok Satpathy has a passion for research in basic sciences. He has been pursuing theoretical research for more than two decades in the field of soft condensed matter physics, in spite of limited resources and facilities. Being an expert in the Statistical-Mechanical Model studies of structure, thermodynamics and transport properties of liquids, metallic glasses and amorphous substances such as molten metals, alloys and ionic (full, partial and complex) liquids, he has developed generalized theoretical models for investigating structural and thermodynamic properties of ionic liquids having mixtures of arbitrary charge and size. He has been popularizing science and its philosophy in society through active involvements in innumerable seminars, talks and other activities spanning throughout his career.

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