ABSTRACT

It is a commendable journey of human race to the 'age of super computers' from calculators, which were once regarded as 'big thing'. One cannot debate over 'integration of novel materials and techniques' being a significant factor in achieving such a giant technological leap. In the contemporary age, sublime developments in science and technology are contributing to the staggering growth of innovations. There are great endeavours for generating novel materials and methods to construct devices of potential use. Prudent interest is judiciously invested towards 'small' dimension materials to achieve 'the next big thing' in the world of devices. This may well be said as materials at the nanoscale dimensions are promising due to their versatile at the same time unique physical and chemical properties. The essence of nanotechnology is to utilize the fundamental knowledge associated with the intriguing properties prevailing at these dimensions. Hence, through effective design strategies properties at these 'small' dimensions prove to be vital in development and transformation of next generation devices and systems.

The current dissertation has been directed towards engineering devices through effective integration of nanomaterials and thereby, use of their physico-chemical attributes. In particular, salient features like catalytic, magnetic, plasmonic and luminescence nature of nanoscale materials developed through bottom-up approach of chemical synthetic routes were availed to accomplish devices with on-board intelligence and clinical importance. A device with the ability to generate electrical energy from autonomous motion of microbots was engineered. Intelligent systems capable of decision making in the liquid media were developed. For disease diagnostics, a bench top device was constructed to perform polymerase chain reaction and array based gene and protein analyses. Another device for photodynamic therapy and optical based detection was achieved. These nanotechnology oriented devices indicate greater prospects and encourage further investigations to achieve other major technological leaps.

Sailapu Sunil Kumar

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