The talk will focus on approaches used to engineer materials at the nanoscale for various applications in future technologies. In particular, the case of carbon nanotubes will be used to highlight the challenges and progress. Various organized architectures of nanotubes can be fabricated using relatively simple processes and the work in attaining control on the directed assembly of these structures will be discussed. Some of these structures offer excellent opportunity to probe novel nanoscale behavior; however, when it comes to engineering such materials into precise architectures, challenges remain. The presenter has pursued several novel applications for these materials, taking into account their multifunctional properties. Some of these promising applications of nanotubes and nanotube-hybrids will be reviewed from the perspective of what has been accomplished in recent years. Presenter’s efforts on the strategies of growth and manipulation of nanomaterials and some of the recent successes in controllably fabricating heterogeneous and complex nanostructures will be highlighted.