

Abstract Submitted  
for the SES13 Meeting of  
The American Physical Society

**Topology and Geometry Perspectives of Functional Materials<sup>1</sup>** S.

GUPTA, Western Kentucky University, A. SAXENA, Los Alamos National Laboratory — In this talk we address the key concept of topology that impacts materials science in a major way, and to the recent significant advances in our understanding of the important topological notions in a wide class of materials with potential technologies. A paradigm of topology/geometry  $\rightarrow$  property  $\rightarrow$  functionality is emerging which goes beyond the traditional paradigm of microscopic structure  $\rightarrow$  property  $\rightarrow$  functionality relation. It delineates the active roles of topology and geometry in designing, fabrication, characterization and predictive modeling of novel materials properties and multi-functionalities. After introducing the basic essentials of topology and geometry, we elucidate these concepts through a gamut of nanocarbon allotropes of de novo carbons, hierarchical self-assembled soft- and bio-materials, supramolecular assemblies, nanoporous materials and so forth. The applications of these topological materials range from sensing, energy storage/conversion, catalysis to nanomedicine, to name a few. We illustrate these concepts through resonance Raman spectroscopy and related experiments on nanocarbons as well as a slew of soft- and bio-materials with an emphasis on topological metrology. We also discuss topological defects (local versus extended) such as Stone-Wales and mitosis, domain walls, vortices, boojums, skyrmions, magnetic monopoles in artificial spin ice and Hopf fibrations as well as other (complex and network) topologies in materials and quantum systems.

<sup>1</sup>We acknowledge both the Department of Energy and CINT-LANL Gateway.

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Date submitted: 18 Sep 2013

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