Journal of
Nanotechnology and Smart Materials

Editorial | Open Access

Smart Materials from Nanotechnology for Global Challenges

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Received Date: November 30, 2013, **Accepted Date:** December 16, 2013, **Published Date:** December 20, 2013

Citation: Gianfranco Pacchioni (2013) Smart Materials from Nanotechnology for Global Challenges. J Nanotech Smart Mater 1:1.

There are several open challenges that our society has to address in the near future: produce sufficient amounts of clean energy from renewable sources, design new technologies that enable a sustainable economic growth, address some relevant environmental issues like quality of air and water or waste recycling, improve our standard of life via more accurate diagnostic tools and new medical treatments, just to mention a few. Most of these challenges deal with the design, synthesis, characterization and industrial production of new smart materials. Smart materials are defined as materials with properties engineered to change in a controlled and desired way. This can be obtained by applying a specific external stimulus like a temperature change, an external voltage, a force, a magnetic field, a change in pH, or a change in concentration of chemical species. Nanoscience and nanotechnology today offer an incredible potential for the conceptual design and the practical realization of radically new smart materials that can help solve some of the aforementioned global challenges.

Smart materials have already been used and are now an intrinsic part of our society. For instance, piezoelectric materials produce a voltage when stressed and are essential parts of telecommunication devices; shape memory alloys alter their shape under the influence of the ambient temperature and are used in aircraft and automotive industries; electrochromic materials change their colour under the effect of a small voltage and find applications in smart windows. The transition from traditional smart materials to smart nanomaterials where the reduced dimensions can provide radically new functionalities is expected to pave the way towards many more applications of practical and social interests. Think for instance of the production of nanosensors that can be used to predict mechanical failure of materials for the fabrication of airplanes, buildings, or bridges; or chemical sensors that can selectively detect the presence of low amounts of a given pollutant or toxic substance in the atmosphere or in the ambient. In the future we may be able to produce nanoparticles that can be incorporated in paints to efficiently capture solar light and convert it into electric energy at a low cost; or nanomaterials that can allow the design of new batteries with high power content and light weight. Not to mention nanoelectronic devices like nanocomputers that can be incorporated in textiles and clothing and provide new functions like a change in hardness as a consequence of an impact. Probably, the field where smart nanomaterials are going to have the largest impact is in healthcare and medicine. We can think of implants and prostheses made from materials that can modify their surfaces and biofunctionality to increase biocompatibility; or specific functionalized nanoparticles that are able to deliver drugs and antibiotics in specific areas of a living organism; or synthetic "cells" that can produce protein drugs when triggered with light.

These are some of the topics that are going to be covered by the new Open Access Journal of Nanotechnology and Smart Materials. The journal aims to become a forum for advanced research in these stimulating and innovative areas. A cross-fertilization among different disciplines is one of the main outcomes that is expected from the publication of top class research papers on this area.