# Preview

Synthetic multifunctional materials are materials designed to accomplish multiple performance objectives in a single system. The term *multifunctional* refers to:

- the use of a material or class of materials for multiple features (electronic, optical, magnetic, etc…);
- the fabrication of multi-component materials with complex structures, capable of exhibiting different physical responses when subjected to various external conditions such as magnetic or electric field, pressure, or electromagnetic radiation;
- the integration of materials with different structural and chemical functions.

They can be designed to accept/donate electrons, react to external stimuli, change the relative positions of their component parts (*i.e.* molecular machines) undergo complex rearrangements and controlled intramolecular motions and generate changes in both macroscopic and molecular properties.
The scientific challenge of these last years is to develop synthetic multifunctional materials utilizing compositional and morphological arrangements to perform at least one additional function.

Furthermore such systems are being developed in which the materials, by changing own properties (such as optical, electrical, or mechanical characteristics) responding to external stimuli, could be considered as "smart" materials.

The ability to optimize and control various physical and chemical properties and to synthesis new molecular materials, has the potential to drive future technological innovation and job growth in the coming decades for applications across different scientific disciplines, including nanoelectronics, energy, communication and medicine.

In the present Ph.D. thesis is reported the study of new pentacoordinated and hexacoordinated gallium compounds obtained starting from the luminescent fragment bis(2-methyl-8-hydroxyquinolinate)gallium(III), $Q'_2Ga-$.

The penta- or the hexacoordination is achieved with a third ligand as phenol and carboxylic acid derivatives or N,N ligands in order to introduce a versatility in the chemical and in the electro-optical features. All the obtained materials exhibit multifunctional properties from the molecular to the supramolecular point of view. The synthesis, characterization and the possible technological applications of these compounds are discussed.

The increasing world safety demand by people and national legislations requires more frequently that the application of new materials and technologies are accompanied by environmental and human health monitoring studies.

An example is the recent European laws about the WEEE materials (waste of electrical and electronic equipments, 2002/95/CE and 2003/108/CE, in Italy Decreto Legis n.151 of 2005-07-25, published on Gazzetta Ufficiale N°176 of 2005-07-30). So the present work will be introduced by a general description of the gallium resources, treatments and the safety issues.