ABSTRACT

Development of magnetic nanoparticles by a solventless thermolytic method and their incorporation in carbon-based matrices

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In this dissertation, a combined morphological and structural study of various magnetic metal oxide nanostructures, which is generally known by the term 'nanoparticles', was achieved. The main objective was to develop magnetic nanoparticles with controlled composition, shape and size by using the solventless method of thermolysis. The aim was to study the surface composition and modification, as well as their nonlinear optical properties. More specifically, metal oxide nanoparticles of γ-Fe_2O_3, α-Fe_2O_3, NiO, Mn_3O_4, CoO and Co_3O_4 were developed by the method of thermolysis, where appropriate selected organometallic compounds decompose at high temperatures in the presence of surfactants. Surface modification of magnetic nanoparticles was also performed in order to change their surface properties from hydrophilic to organophilic. Finally, magnetic nanoparticles were incorporated within carbon-based matrices such as functionalized carbon

nanotubes (CNTs) and graphene oxide (GO) to form novel hybrid structures. Characterization of materials was performed using a combination of techniques such as XRD, FT-IR, TGA, TEM, UV-VIS and Z-scan. Beyond the high importance of these structures in terms of basic physics -which arise primarily from the extremely small size- these materials are potential candidates for applications in areas such as magnetic recording, catalysis and biomedical technology.