Magnetic states in ZnO nanoparticles : The interface between organic and inorganic materials

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ZnO is a widely studied materiel due to its promising properties, as high electron mobility, chemical and thermal stability, photoelectric response, non-toxicity and low cost production. Besides it, ZnO nanoparticles (NP's) produced by sol-gel method stands out in the new technologies scenario due to the interaction with visible light performed by these NP's, which is useful for the development of new light-based dispositives, such as spin-polarized solar cells and spin light-emitting diodes (LEDs). The key point is that part of the magnetic behavior observed in ZnO NP's produced by sol-gel method after illumination by visible light (4052nm) comes from an organic-inorganic interaction that occur in the NP's surface.

The energy provided by the light is not sufficient to promote an electron from the valence to the conduction band in the ZnO (bandgap 3.3 ev) but it's enough to create an pair electron-hole that will interact with organic compounds that surround the NP's in a solvation shell.

This interaction allows the creation of methyl radicals that are stable and observable in EPR. An interesting phenomenon occurs at temperatures near 30K, where the system passes by a transaction and the Curie's law for paramagnetic materials $X = C/T$ is broken.

In this work, we present a physical model supported by different characterization techniques that explains the organic-inorganic interaction in the NP's surface and the behavior of the paramagnetic states at different temperatures.

References:

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