Size dependence of ultrafast electron dynamics and nonlinear optical response of γ-Fe_2O_3 nanoparticles

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During the last two decades, transition metal oxides (TMO) provided a novel platform for the study of several emerging complex phenomena, such as colossal magneto resistance, superconductivity, ferroelectricity etc. [1] Among them, γ-Fe_2O_3 Magnetic Iron Oxide Nanoparticles (MIONS) comprise an important class of nano-sized particles showing unique physical properties (i.e. magnetic and electronic), strongly dependent on the particle size, shape and surface morphology. [2] In this work, we report on the ultrafast time-resolved absorption spectroscopy and the third order nonlinear optical properties of novel MIONs coated with poly-acrylic acid-co-maleic acid (pAcMa) and having various sizes ranging from 3 to 14 nm. The nonlinear optical response as well as the ultrafast relaxation dynamics in the different energy and time domains are analysed and associated with the size of the nanoparticles. In particular, as evidenced by Z-scan measurements, [3] the nonlinear optical response decreases with the size of the nanoparticle. Furthermore, the time resolved spectroscopy measurements indicate that the relaxation dynamics shows a clear dependence on the particle size, with the dynamics being accelerated as the size decreases. The combined results of the nonlinear optical and time resolved experiments will be compared and discussed.

References

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