Manganese Zinc ferrites (MZFO) are a kind of soft magnetic ferrite with high saturation magnetization and low resistivity which are very important ferromagnetic ceramics, particularly for application at high frequencies. Preparing them as nanoparticles and coating them with opportune ligand shells affect their magnetic responses, providing thus new magnetic features for novel applications. To this aim we have synthesized nanosized (~10nm) $Mn_{0.6}Zn_{0.4}Fe_2O_4$ nanoparticles and we attached organic molecules on the surface such as Dopamine, Oleylamine and Citrate, and we investigated their magnetic properties, emphasising the effect of the coating [1], as a function of magnetic field and temperature. Zero field cooled (ZFC) and field cooled (FC) thermal variation of the magnetization, isothermal remnant magnetization (IRM) and Direct Current Demagnetization remanence (DCD) [2] were thus measured. In these nanostructured complex systems several factors contribute to the magnetic response such as particle size and morphology, interface nature, chemical phases as well as compositional changes and modifications down to the atomic scale. We combined complementary state of the art techniques to gain an indepth and reliable knowledge of these systems looking at the chemical interactions with the coating organic shells by FTIR and TGA, the morphology and size of coreshell particles by HR-TEM, the crystallographic phases by laboratory XRD. Furthermore, the Fe-K edge XAFS technique has applied to finely describe the coordination chemistry, electronic state and local atomic structure around Fe in the magnetic phase [3]. This information, related to the magnetic characterization, allowed us to reliably understand the origin of the magnetic response in these nanohybrid systems. MZFO doped with Dopamine depict anomalous magnetic response with a lower blocking temperature and unsaturated magnetization suggesting the present of iron in nitrate local structure from XANES study.