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Understanding the Role of Oxygen in $CoFeO_x$ Superparamagnetic Nanoparticles PAMELA JEPPSON, TONY CARUSO, DOUG SCHULZ, ROB SAILER, SUPERPARAMAGNETISM TEAM — There is a present need for materials which provide both magnetic flux isolation and concentration. The primary application of such materials regards coatings for very sensitive (picotesla) magnetic field measurement or applied magnetic fields. The coatings help reduce 1/f noise and provide a means of controlling wanted or unwanted, internal and/or external magnetic fields. For the high permeability superparamagnetic materials that are presently in use, severe thin film limitations are keeping picotesla resolution from being realized. An example of such present limitations is the strain encountered in thin permalloy films. Beyond strain, there is also brittleness which impedes many inorganic, metallic films. The original goal of this research was to develop flexible and insulating superparamagnetic materials to help fulfill the present thin film limitations and to provide new applications, which utilize the insulating and/or flexible nature of the composite films. However, after optimizing the magnetic properties, we found an extreme saturation moment for some parameters of the transition metal oxide based films. The extreme saturation moments are attributed to the oxygen ratio and termination at the surface of the nanoparticle. This talk will focus on the surface magnetic structure and how it can enhance or suppress the soft properties of transition metal based oxide superparamagnetic nanoparticles. .

Tony Caruso

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