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**Surface pinning effect and emergent magnetic properties in bi-phase iron oxide nanorods**[1] SUPUN B ATTANAYAKE, AMIT CHANDA, University of South Florida, RAJA DAS, Phenikaa University, MANH-HUONG PHAN, HARIHARAN SRIKANTH, University of South Florida — Over the years, iron oxide ($Fe_3O_4$) nanorods (NRs) have been investigated for advanced magnetic hyperthermia, and spintronics applications. Here we propose a unique approach in creating a novel class of bi-phase (BP) iron oxide NRs. We demonstrate the formation of $Fe_3O_4+\alpha$-$Fe_2O_3$ BP NRs through a controlled annealing process. Hydrothermally grown $Fe_3O_4$ NRs were annealed at $250^0$C for different periods (1-9h) to form $Fe_3O_4+\alpha$-$Fe_2O_3$ BP structures. Magnetometry measurements indicate the sharpening of the Verwey transition with the increment of the annealing duration, leading to the improved crystallinity of the $Fe_3O_4$ phase. Compared to the as-synthesized, the annealed NRs have a reduced saturation magnetization ($M_S$) owing to reduced volume fraction of $Fe_3O_4$ and concomitant formation of the antiferromagnetic $\alpha$-$Fe_2O_3$ phase. With 5h of annealing a sharp drop in magnetization is observed due to Morin transition around 260K associated to $\alpha$-$Fe_2O_3$ phase. The presence of canted/disordered spins at the phase boundary between the $Fe_3O_4$ and $\alpha$-$Fe_2O_3$ phases can be observed as the NRs are cooled down in 1T field from room temperature. With these observations the $Fe_3O_4+\alpha$-$Fe_2O_3$ BP NRs would be an excellent model system for probing interfacial nanomagnetism.

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