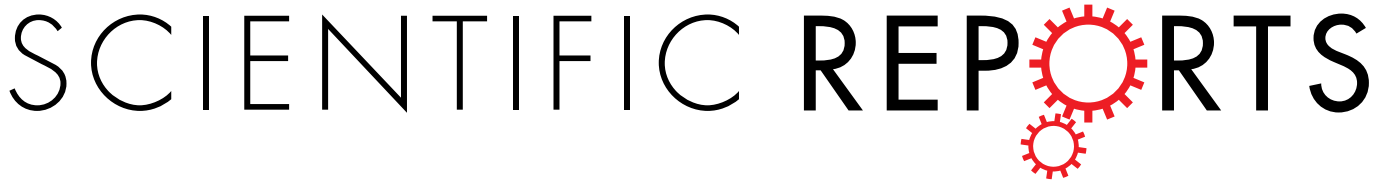

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Giant thermal hysteresis in Verwey transition of single domain Fe_3O_4 nanoparticles

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Most interesting phenomena of condensed matter physics originate from interactions among different degrees of freedom, making it a very intriguing yet challenging question how certain ground states emerge from only a limited number of atoms in assembly. This is especially the case for strongly correlated electron systems with overwhelming complexity. The Verwey transition of Fe_3O_4 is a classic example of this category, of which the origin is still elusive 80 years after the first report. Here we report, for the first time, that the Verwey transition of Fe_3O_4 nanoparticles exhibits size-dependent thermal hysteresis in magnetization, ^{57}Fe NMR, and XRD measurements. The hysteresis width passes a maximum of 11 K when the size is 120 nm while dropping to only 1 K for the bulk sample. This behavior is very similar to that of magnetic coercivity and the critical sizes of the hysteresis and the magnetic single domain are identical. We interpret it as a manifestation of charge ordering and spin ordering correlation in a single domain. This work paves a new way of undertaking researches in the vibrant field of strongly correlated electron physics combined with nanoscience.