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Competing effect of blocking and spin frustration in nanostructured gadolinium iron garnets M.H. PHAN, M.B. MORALES, H. SRIKANTH, University of South Florida, C.N. CHINNASAMY, V.G. HARRIS, Northeastern University — The ground state magnetic properties and relaxation mechanism in magnetically frustrated system of $Gd_3Fe_5O_{12}$ is of topical interest due to its complex magnetic structure. As a consequence of geometric and magnetic frustrations, the $Gd_3Fe_5O_{12}$ system is expected to show glassy magnetic behavior. Through a comprehensive study of DC magnetization, AC susceptibility, transverse susceptibility, and magnetocaloric effect in $Gd_3Fe_5O_{12}$ bulk and nanostructured materials, we provide physical insights into the glassy nature and magnetic relaxation mechanisms in the gadolinium iron garnet system. It is shown that bulk $Gd_3Fe_5O_{12}$ undergoes two different glassy states at temperatures below its compensation temperature with the low temperature glass properties strongly influenced by Gd ordering. However, the glassy nature is largely suppressed in $Gd_3Fe_5O_{12}$ nanoparticles in which the blocking phenomenon competes with the spin frustration effect. As particle size is decreased, the blocking effect is dominant over the spin frustration effect. As a result, the nanostructured system shows magnetic relaxation features arising mainly from superparamagnetism.

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