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Mechanochemical Synthesis of ZnFe2O4 as a Function of "Ball to Powder Ratio" (BPR) JARI CABARCAS, ERMIDES CHAVEZ, YARI BABILONIA, Universidad de Puerto Rico, OSWALD UWAKWEH, Recinto Universitario de Mayagüez — Mechanochemical reactions of ZnO and α-Fe_2O_3 were carried out in a planetary mill to produce zinc ferrite ($ZnFe_2O_4$) nanocrystallites at room temperature by using a "ball to powder ratio" (BPR) of 20:1 and 40:1, under identical processing conditions entailing initial addition of 0.6 mL of acetone as surfactant with hardened stainless steel grinding materials. The average crystal sizes of the particles as determined from X-ray diffraction measurements varied as a function of milling time, with the value of 7.36 nm achieved for the 35 hours milled materials. The diffraction peaks of the milled samples are broadened, which can be the result of the reduced grain size and the atomic level strain introduced during milling. The development of superparamagnetic behavior of the particles is confirmed by the presence of a central peak in the Mössbauer spectra for 50h and 10h corresponding to BPR= 20:1 and BPR=40:1 respectively. This result has been explained on the basis that at a high BPR, the collision energy is high and therefore leads to enhanced reduction in crystal size and the chemical reaction to single phase $ZnFe_2O_4$ having the particle size dependent superparamagnetic behavior.

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