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Magnetodielectric Effects and Transport Study in LuFe$_2$O$_4$ Single Crystal

TAE HWAN JANG, SANG YOUN PARK, eSSC & Dept. of Physics, POSTECH, Korea, HAII JOON LEE, SUN HEE KANG, Dept. of Physics, Ulsan Univ., Korea, TAE YEOONG KOO, PAL, POSTECH, Korea, SUNG BAEK KIM, I-PEM & Dept. of Physics, POSTECH, Korea, ILL WON KIM, Dept. of Physics, Ulsan Univ., Korea, YOON HEE JEONG, eSSC & Dept. of Physics, POSTECH, Korea, SANG WOOK CHEONG, R-CEM and Dept. of Physics & Astronomy, Rutgers Univ., USA — Magnetic, dielectric, and magnetodielectric properties of geometrically frustrated mixed valance LuFe$_2$O$_4$ single crystal are discussed to clarify the charge order based ferroelectricity and its coupling with magnetism. From the magnetization and dielectric constant measurement, a new anomalous temperature point $T_N' (\sim 160$ K) in both magnetization and dielectric constant versus temperature curve below the ferrimagnetic transition temperature $T_N (\sim 225$ K) has been observed. The sign of magnetodielectric effect (MDE) also changes from positive $T > T_N'$ into negative $T < T_N'$. No field hysteresis in positive MDE temperature region was found. However a large hysteretic behavior in negative MDE below $T_N'$ with the same magnetic coercive field measured in M (H) curve was observed. This indicates a strong coupling between magnetism and ferroelectricity in the charge and spin frustrated ferrimagnetic LuFe$_2$O$_4$ system.

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