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Unexpected magnetism, and transport properties in mixed lanthanide compound.[1] ARJUN PATHAK, KARL GSCHNEIDNER, JR, VITALIJ PECHARSKY, Ames Laboratory, US DOE, AMES LABORATORY TEAM — For intelligent materials design it is desirable to have compounds which have multiple functionalities such as a large magnetoresistance, ferromagnetic and ferrimagnetic states, and field-induced first-order metamagnetic transitions. Here, we discuss one such example where we have combined two lanthanide elements Pr and Er in $Pr_{0.6}Er_{0.4}Al_2$. This compound exhibits multiple functionalities in magnetic fields between 1 and 40 kOe. It undergoes only a trivial ferrimagnetism to paramagnetism transition in a zero magnetic field, but $Pr_{0.6}Er_{0.4}Al_2$ exhibits a large positive magnetoresistance (MR) for H$\geq$40 kOe, a small but non negligible negative MR for H$\leq$30 kOe, and a clear Griffiths-like phase behavior at $<$1 kOe. The compound also exhibits an asymmetry of hysteresis loop, or exchange bias (EB) effect after field cooling from the paramagnetic state. These phenomena are attributed to the competition between single-ion anisotropies of Pr and Er ions coupled with the opposite nearest-neighbor and next-nearest-neighbor exchange interactions.

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