Hall Effect Anisotropy in the Paramagnetic Phase of $Ho_{0.8}Lu_{0.2}B_{12}$ induced by the Jahn-Teller lattice instability

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A detailed study of charge transport in the paramagnetic phase of the cage-cluster dodecaboride $Ho_{0.8}Lu_{0.2}B_{12}$ with an instability of (*i*) the *fcc* lattice (static and dynamic cooperative Jahn–Teller effect) and (*ii*) the electronic structure (dynamic charge stripes) was carried out at temperatures 1.9–300 K in magnetic fields up to 80 kOe. Four mono-domain $Ho_{0.8}Lu_{0.2}B_{12}$ single crystals with different crystal axes orientation were investigated in order to establish the singularities of Hall effect, which develop due to the electronic phase separation (stripes) and formation of the disordered cage-glass state below $T^* \sim 60$ K. It was demonstrated that a considerable intrinsic anisotropic positive component $\rho^{an}{}_{xy}$ appears at low temperatures in addition to the ordinary negative Hall resistivity contribution in magnetic fields above 40 kOe applied along the [001] and [110] axes. A relation between anomalous components of the resistivity tensor $\rho^{an}{}_{xy} \sim \rho^{an}{}_{xx}{}^{1.7}$ was found for $\boldsymbol{H}\|[001]$ below T^* ~ 60 K, and a power law $\rho^{an}{}_{xy} \sim \rho^{an}{}_{xx}{}^{0.83}$ was detected in the orientation $\boldsymbol{H}\|[110]$ at temperatures $T < T_S \sim 15$ K. It is argued that below characteristic temperature $T_S \sim 15$ K the anomalous odd $\rho^{an}{}_{xy}(T)$ and even $\rho^{an}{}_{xx}(T)$ parts of the resistivity tensor may be interpreted in terms of formation of long chains in the filamentary structure of fluctuating charges (stripes). We assume that these $\rho^{an}{}_{xy}$ ($\boldsymbol{H}\|[001]$) and $\rho^{an}{}_{xy}$ ($\boldsymbol{H}\|[110]$) components represent the intrinsic (Berry phase contribution) and extrinsic (skew scattering) mechanism, respectively. Apart from them, an additional ferromagnetic contribution to both isotropic and anisotropic components in the Hall signal was registered and attributed to the effect of magnetic polarization of 5*d* states (ferromagnetic nanodomains) in the conduction band of $Ho_{0.8}Lu_{0.2}B_{12}$.