# Genesis of collective modes in the dynamic conductivity of higher borides $RB_6$ and $RB_{12}$ with cooperative Jahn–Teller instability

M. A. Makrushin[1,2], P. I. Arseev[3], K. M. Krasikov[3],
E. S. Zhukova[4], and N. E. Sluchanko[1]

[1]*Prokhorov General Physics Institute of Russian Academy of Sciences, Moscow, Russia*
[2]*Faculty of Physics, Moscow State University, Moscow, Russia*
[3] *Lebedev Physical Institute of Russian Academy of Sciences, Moscow, Russia*
[4]*Center for Photonics and 2D Materials, Moscow Institute of Physics and Technology (State University), Dolgoprudnyi, Russia*

A one-dimensional model is proposed [1] to describe anomalies in the *ac* conductivity spectra of rare-earth and transition metal hexaborides $RB_6$ and dodecaboride $LuB_{12}$ with cooperative Jahn-Teller lattice instability of a rigid boron framework (ferrodistortive effect). The developed approach is based on the dipole nature of the action of the ionic component participating in the collective vibrations of the boron framework on conduction electrons. The correction $\delta\sigma(\omega)$ to the Drude-type *ac* conductivity was obtained using the Boltzmann equation in the tau approximation. The simulation results are compared with the experimental $\delta\sigma(\omega)$ spectra (see, for example, Fig. 1) and the sizes of vibrational clusters, the relaxation rate, and the damping coefficient in various $RB_6$ and $RB_{12}$ crystals are estimated [1]. The contribution of the molecular current to the *ac* conductivity is also discussed.

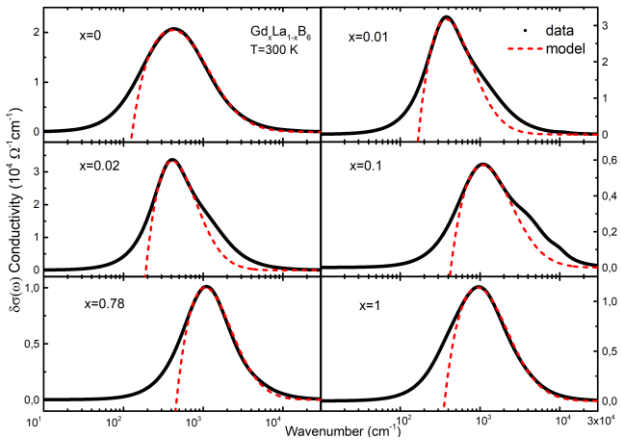


**Fig.1.** An example of the implementation of the model in comparison with the experimental spectra $\delta\sigma(\omega)$ for $Gd_xLa_{1-x}B_6$ with various $x$.

[1] M. Makrushin; P. I. Arseev; et al., *JETP Letters* **Vol. 117** pp. 456 (2023).