The search for new RGB phosphors for wLED is of important interest nowadays. Rare- and alkaline-earth borates have attracted the attention of researchers due to luminescence makes them prospective phosphors, scintillators. Five (Lu, Ba)-borates are known: LuBa$_3$B$_3$O$_9$, LuBa$_3$B$_9$O$_{18}$ and recently obtained Lu$_5$Ba$_2$B$_5$O$_{17}$ (Hermus et al., 2017), Lu$_2$Ba$_3$B$_6$O$_{15}$ (Biryukov et al., 2019) and Lu$_5$Ba$_6$B$_9$O$_{27}$ (Filatov et al., 2019). Partially substituted by Ce, Yb and Eu, the borates exhibit good and even excellent luminescence (Lu$_2$Ba$_3$B$_6$O$_{15}$:Ce,Tb).

This work is devoted to synthesis of Lu$_5$Ba$_6$B$_9$O$_{27}$ and Lu$_2$Ba$_3$B$_9$O$_{18}$, its structure determination from single-crystal, powder XRD data, investigation of thermal properties of these borates and LuBa$_3$B$_9$O$_{18}$ using TG, DSC, HTXRD. The Lu$_5$Ba$_6$B$_9$O$_{27}$ structure is composed of the BO$_3$ triangles, the cubic Lu$_2$Ba$_3$B$_6$O$_{15}$ is built from the B$_2$O$_5$ groups, LuBa$_3$B$_9$O$_{18}$ structure - from the B$_3$O$_6$ groups. The thermal expansion is considered as a function of not only polyanions contribution but also of cations one.

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