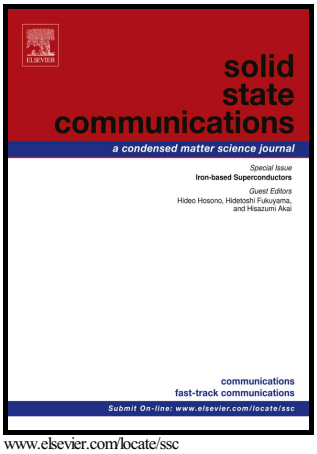

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Crystal Electric Field Effects and Thermal Expansion of Rare-Earth Hexaborides

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Abstract

Anomalies in the magnetic contribution to the thermal expansion coefficients $\Delta\beta(T)$of the CeB_6, PrB_6, and NdB_6 hexaborides in the range of 5-300 K were found by comparison with diamagnetic LaB_6. The characteristic of the anomalies was the same in all the studied borides: a distinct peak at low temperatures, followed by a broad maximum at higher temperatures (50–100 K), then a decrease and transition to the region of negative values as the temperature increases further. The features of $\Delta\beta(T)$ are explained by the effects of the magnetic order (sharp low temperature peaks) and the crystal electric field (CEF). The $\beta_{CEF}(T)$ dependencies were calculated using Raman and neutron scattering data on the splitting of the rare-earth (RE) ions R^{3+} f-level by the CEF. A satisfactory consistency between the values of $\beta_{CEF}(T)$ and $\Delta\beta(T)$was obtained for the studied hexaborides. Additionally, we determined the values of the Grüneisen parameter γ_i that correspond to the transition between the ground and excited multiplets of R^{3+} ions f-level splitting.