Stacking Faults and Internal Strains in DHCP Phase of La

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High-resolution synchrotron X-ray diffraction measurements of La have been carried out in the range of temperatures from 80 K to 800 K at ambient pressure. The powder diffraction patterns contained characteristic features of DHCP crystals with stacking faults. Additional peak broadening was attributed to a lattice strain. A considerable amount of lattice strain along a stacking direction can consistently account for an upward jump of the close-packed interplanar spacing observed in course of the DHCP-to-FCC phase transition at about 500 K, contrasting with the downward atomic volume jump at this phase transition.

Quantitative analysis of basic parameters of the planar defects along with strain calculations is presented. The temperature evolution of stacking faults concentration and lattice strain in DHCP structure of La indicates on an equilibrium nature of the observed lattice imperfections rather then on a non-equilibrium one. Such an equilibrium microstructure can arise due to an additional gain in electronic energy, which stabilizes the DHCP lattice, at cost of elastic distortive energy [1]. The analysis of X-ray measurements complemented by TEM study shows that a partial relaxation of the induced short-range elastic stresses can proceed via incretion of stacking faults in DHCP structure of La.

[1] Zangwill A., Bruinsma R., *Comments Cond. Mat. Phys.*, 1987, **13**, 1.

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