Disorder in both allotropic phases of pure single-crystalline cobalt was studied by elastic neutron scattering in order to separate bulk from surface effects and to remove diffuse inelastic contributions. The intensity variation along \((10L)\), measured at different temperatures, was analysed in terms of Jagodzinski disorder theory (Acta Crystal. (1948) 1, 201). The values found for the degree of disorder in the hcp-phase were lower than those reported before for powder samples and remain nearly unaffected when approaching the transition temperature. The fcc-phase is always (below and above the transition) well ordered. However, the temperature behaviour of the fcc- and hcp-precursor regimes in the hcp- and the fcc-modifications, respectively, is different.

The origin of the hcp-fcc transition is restricted to a few nuclei only, which are preformed below \(T\). The transition corresponds to a nucleus growth process. These nuclei are well ordered packets of at least 100 layers with ABC sequence. The transition mechanism is triggered by an elastic shear wave which shows an anomalous temperature behaviour in the critical region (Frey et al., J. Phys. F (1979) 9, 603). The back transformation fcc-hcp is due to a different mechanism, as no true preformed hexagonal nuclei exist above \(T\). In a model proposed by Seeger(Z. Metallk. 1953) 44, 247 a special defect configuration corresponds to a "nucleus" for the hcp-phase, running half-dislocations provide the martensitic transition.