corresponds to the austenitization stage of III in Figure 6 a).

To produce an acceptable homogenized microstructure, the steel has to be reheated or held in the austenite temperature region for a longer time, for the purpose of dissolving retained cementite and eliminating uneven chemical composition in austenite. A uniform carbon distribution in austenite, which is equal to the average carbon content in the virgin material, will be the final result (Curve IV in Figure 6 b)). This process is termed homogenization, which is also a carbon diffusion controlled process for the Fe-C steel.

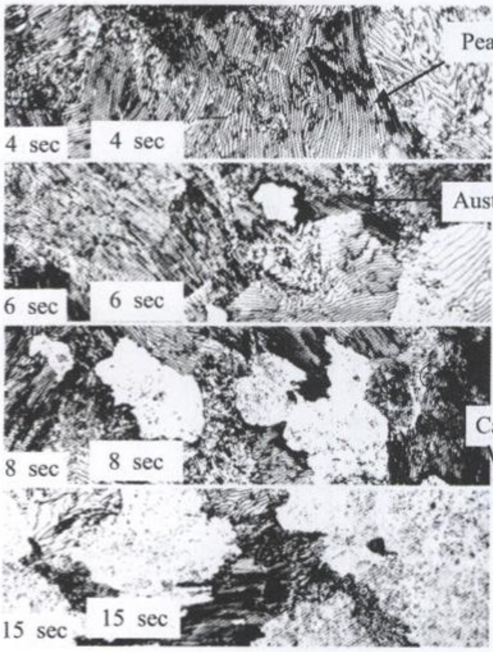

Fig. 5. Undissolved carbide in the growing austenite region from a parent structure of pearlite, with the time increase indicated.

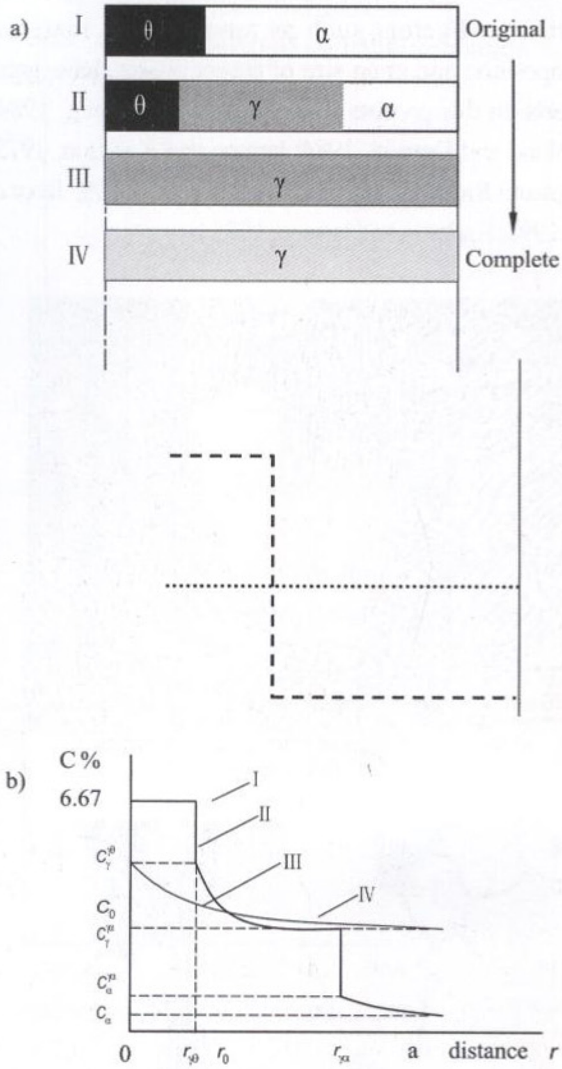

Fig. 6. Austenite grain growth and homogenization. a) Different austenitization states of the θ - α phasaes; b) Carbon distribution profile at different austenitization states.

3. Modelling techniques for austenitization of steels

3. 1. Austenitization between α and θ phases

In lamellar pearlite steels, for example, austenite is assumed to nucleate instantaneously at the carbide-ferrite interfaces, followed by the diffusion controlled austenite grain growth process. This is illustrated in Figures 4 and 6. Nucleation of austenite is always taken as the initial condition of the subsequent austenite grain growth and homogenization. Basic assumptions are necessary to simplify the modelling in an Fe - C binary system (Akbay *et al.*, 1994; Judd and Paxton, 1968; Reed *et al.*, 1998; Atkinson and Akbay, 1996)

1) Local equilibrium is assumed to hold at all ferrite-austenite and cementite-austenite phase boundaries.

2) The diffusion of carbon in ferrite and cementite is ignored.

3) The effect of capillarity is neglected.

4) The diffusivity of carbon is concentration and temperature dependent.

5) The effects of capillarity on the dissolution rate of