Study of Crystallographic Aspects of the Formation of pearlite in Carbon Steels Using Transmission Electron Microscopy Ping Liu, *Research and Development Centre, Sandvik Materials Technology, Sweden, and Research and Development Centre, Sandvik Materials Technology, SE 811 81 Sandviken, Sweden*. E-mail: ping.liu@sandvik.com

Keywords: Pearlite; Carbon Steels; TEM

Pearlite consists of alternative layers of ferrite (α, Im3m, a=2.8664 Å) and cementite (Fe_3C, Pnma, a=5.0910 Å, b=6.7434 Å and c=4.5260 Å). The formation of pearlite is considered to be relevant to the behaviour of most steel although it is thermodynamically metastable [1]. Honeycombe based on the free energy calculation gave a pearlite growth model [2].

In the present study formation of pearlite in steel was characterised using transmission electron microscopy (TEM) and crystallographic aspects were revealed. It was shown by electron diffraction that the layers structure of pearlite were parallel to the crystallographic planes of $(200)_{Fe_3C}//(\bar{2}22)_\alpha$ and the elongated direction of the cementite is parallel to the crystallographic direction of $[002]_{Fe_3C}//[\bar{1}\bar{1}0]\alpha$ and the third detention of the cemente is the crystallographic direction of $[010]_{Fe_3C}//[\bar{1}12]_\alpha$. Based on these results a modified model for pearlite growth is given in Fig.1. The morphology of pearlite can now be interpreted in terms of differences in the lattice mismatch and anisotropy diffusion. Large lattice mismatch facilitates the growth and the so-called short-path diffusion through dislocation and grain boundaries is anisotropic.

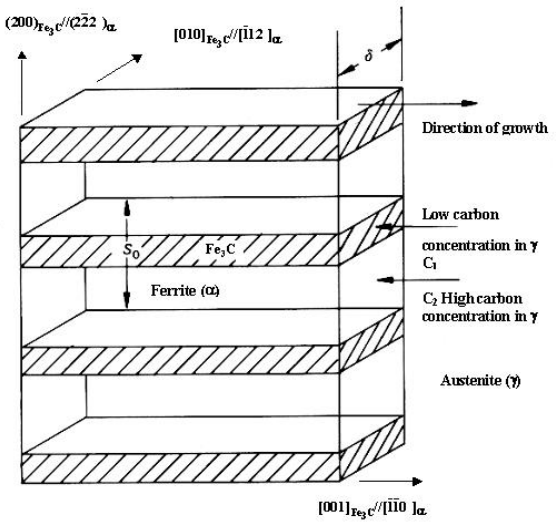

Fig.1. The crystallographic aspects of pearlite growth.

[1] R. W. K. Honeycombe, (1981). Steels, Microstructure and Properties, Edward Arnold, London, pp.39-54.
[2] Idib.pp28-54.