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(24) Reduction of iron ores in fluidized beds

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During the reduction of iron ores two limits of efficiency arise: 1. the increase of fines under reducing conditions and 2. the appearence of sticking between the particles.

1.) In fluidized beds the productivity goes up with higher temperature and gasvelocity, but then a large degradation appears. While changing hematite particles into magnetite and wustite an anisotropic reduction velocity occurs, that means the reduction speed is hihger parallel to the C-axis than in other directions. Also, an increase of volume can be measured and the bindings between the grains become weak. The small particles have cracks at the corners, (see figure 1). By this hematite particles loose their strength and a higher amount of fines appear by abrasion, than under normal conditions, e.g. the same temperature and same streaming conditions but nitrogen atmosphere.

2.) The second limit does not only decrease the efficiency of a reduction fluidized bed, even it may stop the whole process.

a) Due to the recristallisation the particles grow together. It was observed that already at $^2/_3$ of the melting temperature of the ores the particles form clusters by intensive diffusion. During the reduction of ores with a special gangue content and low melting point at even lower reduction temperatures the particles grow together.

b) While changing wustits into iron, needles of iron may be formed. These needles are linked together and recrystallise. Different formations of iron needles appear by changing the red.-temp., red.-time, gascomposition and kinds of ores. The formation mostly depends on the nucleus situation. Not the number of nucleuses but the kind of nucleus situation, e.g. screw dislocation and diffusion speed are important. (see figure 2)

Fig. 1 Cracks at the corners of the small particles.

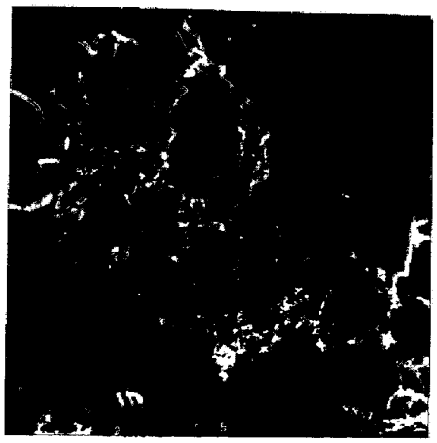

Fig. 2 Needlesof iron formed by reduction.