(167) OBSERVATION OF FIBROUS IRON GROWTH DURING REDUCTION OF IRON ORES WITH CO GAS

RWTH Aachen, Institut für Eisenhüttenkunde: Mutsuhiro Kobayashi", Heinrich W. Gudenau
(" Tokyo Institut of Technology) Willy G. Burchard, H. Christian Schaefer

1. Introduction Abnormal swelling during reduction of iron ores and pellets has been observed and related to fibrous metallic iron growth. Many models[1-3] for the growing mechanism have been proposed but might remain unsuccessful by lack of knowledge on the initial state of the fibrous iron growth from a wustite surface. This study[4] was aimed to observe the growth in-situ by means of a scanning electron microscope (SEM) equipped with a sample heating device and a reducing gas supply.

2. Experimental Specimens were reduced on a directly heated platinum boat in the SEM under various reducing atmospheres. SEM photographs were taken 1) before and after each intermittent reducing run under a higher gas pressure and 2) in-situ on a continuous reducing run under a lower gas pressure. After each run, surface morphology and color of the specimen were observed by means of a stereo optical microscope.

3. Results and discussion Surface morphology showed to depend upon temperature, CO/CO_2 gas ratio, gas pressure, reducing time, degree of pretreatment, kind of ores and oxides, particle size, specimen volume, etc.; these parameters could affect the rate of chemical reaction and/or the diffusion rate of products. In Fig.1 at the point of 800°C and 70% CO could be seen typical iron fibers with no lateral iron precipitate on the surface (Photo 1). Photos of SEM (Photo 1) and cross section (Photo 2) revealed the fibrous iron growing on the surface.

The fibrous iron was considered to grow fast from a supersaturated wustite, followed by lateral growth of iron precipitates on the wustite surface from the foot of the iron fiber. Various types of iron fibers could be represented as the intermediate state between fibrous and topochemical growths.

Ref. 1) M. Ponthenkandath: Diss. RWTH Aachen (1971). 2) H. de Haas et al.: Arch. Eisenhüttenw., 51(1980), 167. 3) R. Nicolle and A. Rist: Metall. Trans. B, 10B(1979), 429. 4) H. C. Schaefer: Dr.-Eng. thesis RWTH Aachen, to be published.

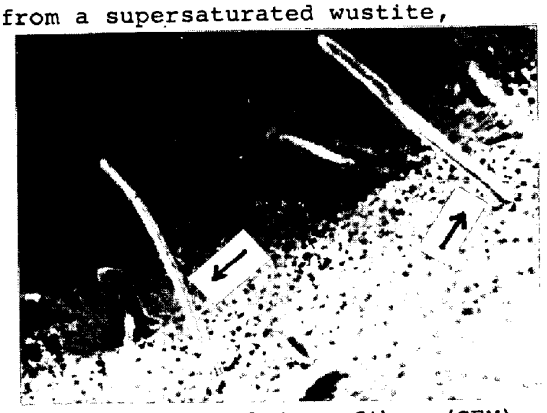

Photo 1. Typical iron fiber (SEM).

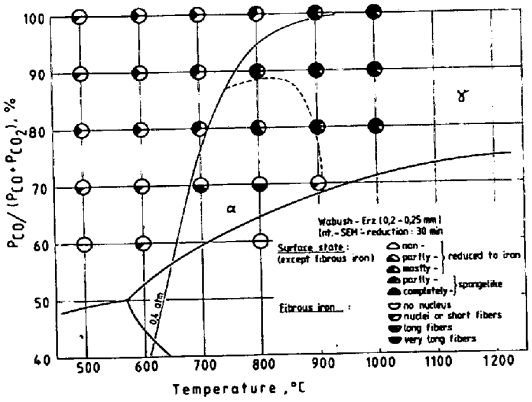

Fig. 1. Surface morphology as a function of temperature and CO gas concentration.

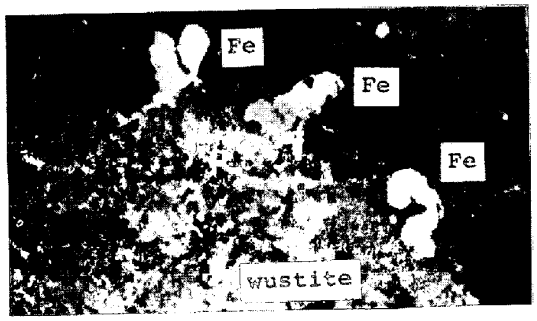

Photo 2. Cross section of a reduced ore.