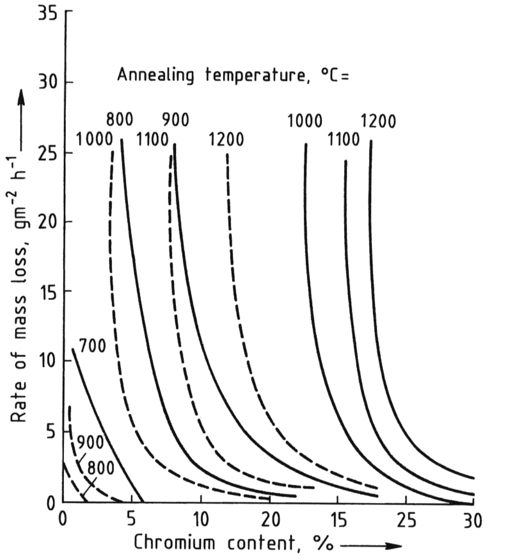

Figure 2. Influence of the silicon and chromium contents on the scaling resistance of steel during annealing in air for 120 h
—— 0.5 – 1.0 % Si; – – – 2.0 – 3.0 % Si

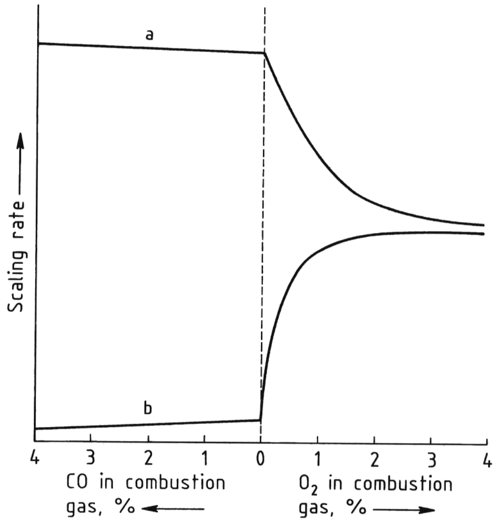

Figure 4. Scaling of soft steel at 850 °C in combustion gases from sulfur-containing and sulfur-free fuel
a) 0.15 % SO_2; b) SO_2-free

incompletely burnt gases. In gases containing sulfur the situation is reversed. In combustion gases containing oxygen, the sulfur content of the gas has practically no influence, whereas the scaling rate increases in incompletely burnt gases [5]. The behavior depicted in Figure 3 is observed in many cases. To understand this behavior, thermodynamic and kinetic considerations are necessary.

The isothermal section through the Fe – O – S system (Fig. 5) shows how the stability of the individual phases changes as a function of the oxygen and sulfur pressure. For a given sulfur content of a gas, the oxides are stable at high oxygen pressure; at low oxygen pressure, however, the sulfides are stable. That is why oxides are stable in fully burnt gases containing sulfur, and sulfides are stable in incompletely burnt gases because of their very low oxygen pressure. These thermodynamic considerations alone, however, are not sufficient to avoid sulfide formation in gases containing sulfur and oxygen. Kinetic measurements show that where oxides

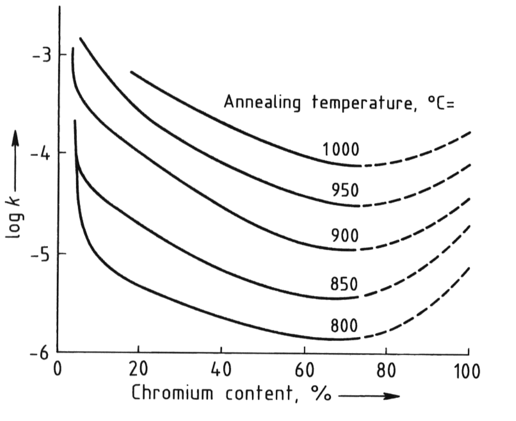

Figure 3. Dependence of the sulfurization constant k of steels on the chromium content in the temperature range 800 – 1000 °C
$k = \left(\frac{\Delta m}{A}\right)^2 \dot{s} \frac{1}{t}$
Δm = Mass increase, g; A = Surface area, m^2; t = time, min

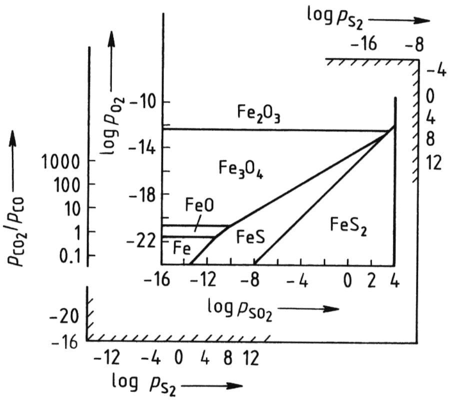

Figure 5. Isothermal section through the Fe – O – S system at 700 °C