

Comparison of equilibrium calculations and real corrosion scales. Useless or necessary?

Axel Kranzmann, Kathrin Nützmann

Bundesanstalt für Materialforschung und -prüfung, 12200 Berlin

The formation of sulfate and sulfide phases in flue gases is one of the attacks during corrosive reactions. The transport of sulfur into an oxide scale is still under discussion. It is not clear to which amount sulfur can be dissolved and transported in the grain boundaries of the oxide scale. Our experimental work simulates different conditions and observe the formation of the phases. The calculation of the heterogeneous equilibria and the comparison with the phase in the scale shows a high consistence. And calculations can be used to give first information for analytical methods. The use of thermodynamic calculations in the BAM corrosion group will be demonstrated. The examples will focus on reactions were sulfur is involved.

Equilibrium diagrams are frequently used to discuss sulfur – metal equilibria. FeSO_4 or $\text{Fe}(\text{SO}_4)_3$ are frequently observed in corrosion experiments near the gas interface and in oxide scales. Contrary to thermodynamic calculations experimental observations neglect the thermal stability of both phases above 600 °C. In this cases the equilibrium phase diagrams have to be modified to represent the experimental data.

Examples of Sulfide and Sulfate phase formation in corrosion scales grown under different conditions and their thermodynamic stability will be discussed using FactSage 7.0