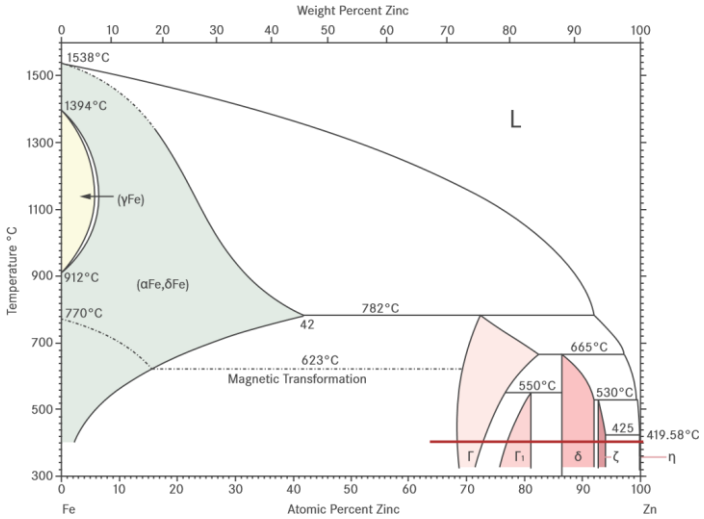
Tech info:

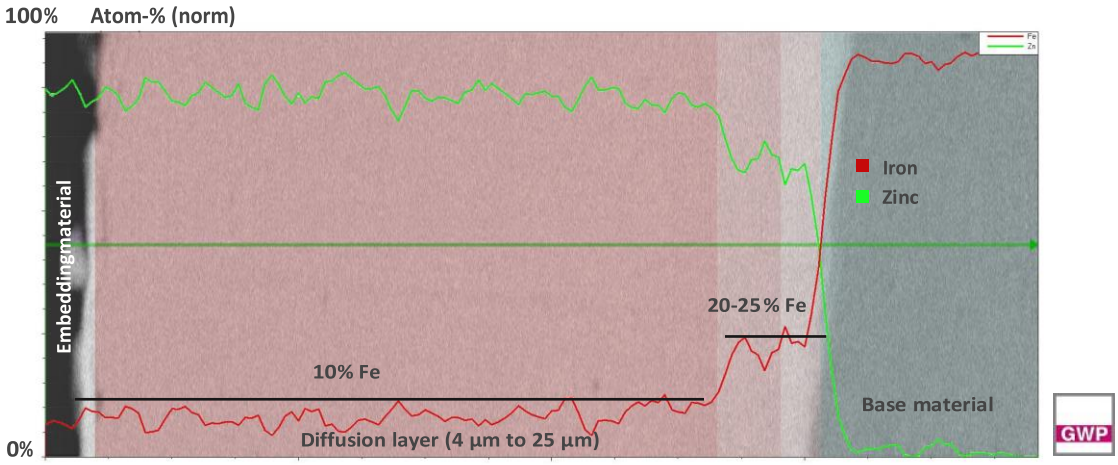
Layer structure of the surface protection

This paper describes the layer structure of zinc thermal diffusion and the formation of intermetallic phases.

During the thermal diffusion, an interdiffusion of zinc and iron takes place that leads to the formation of intermetallic phases (microalloys). The sequence of the phases and the composition ranges is predicted in the Fe-Zn phase diagram (the red line corresponds to approx. 400°C).



According to the Fe-Zn phase diagram, the sequence of intermetallic phases (microalloys) of the steel/iron in the direction of the surface is as follows: α (ferrite solid solution of the steel/iron), Γ , Γ_1 , δ, ζ, η (zinc solid solution); valid between 300 - 400°C. Using the REM line scan, the local composition of the layer structure can be analyzed.



Testing and validation by external material testing institute

This shows that the majority of the layer consists of Zn, with approximately 10% Fe. Close to the steel, the iron content increases to about 20-25%; there is then an abrupt transition to steel where only traces of zinc are found. A comparison of these composition data with the phase diagram shows that the 10% Fe corresponds to the δ phase, while the 20-25% Fe range is shared between the Γ and Γ_1 phases. A very small quantity of zinc is also found in the adjacent steel as α solid solution. Areas with a composition <10% Fe near the ζ and η phases are not detected in the line scan.

Source phase diagram: 2 binary systems: Fe – Zn Landolt-Börnstein New Series IV/19B