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The Determination of the Phosphorous Solubility in the Iron by the Function of the Other Components

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Abstract : The phosphorous is the important components in the steels, because it makes the changing of the mechanical properties and possibly modifying the structure. The phosphorous can be create the Fe3P compounds, what is segregated in the ferrite grain boundary in the intervals of the nano-, or microscale. This intermetallic compound is decreasing the mechanical properties, for example it makes the blue brittleness which means that the brittle created by the segregated particles at 200 ... 300°C. This work describes the phosphide solubility by the other components effect. We make calculations for the Ni, Mo, Cu, S, V, C, Si, Mn, and the Cr elements by the Thermo-Calc software. We predict the effects by approximate functions. The binary Fe-P system has a solubility line, which has a determinating equation. The result is below: lnwo = -3,439 – 1.903/T where the w0 means the weight percent of the maximum soluted concentration of the phosphorous, and the T is the temperature in Kelvin. The equation show that the P more soluble element when the temperature increasing. The nickel, molybdenum, vanadium, silicon, manganese, and the chromium make dependence to the maximum soluted concentration. These functions are more dependent by the elements concentration, which are lower when we put these elements in our steels. The copper, sulphur and carbon do not make effect to the phosphorous solubility. We predict that all of cases the maximum solubility concentration increases when the temperature more and more high. Between 473K and 673 K, in the phase diagram, these systems contain mostly two or three phase eutectoid, and the singe phase, ferritic intervals. In the eutectoid areas the ferrite, the iron-phosphide, and the metal (III)-phospide are in the equilibrium. In these modelling we predicted that which elements are good for avoid the phosphide segregation or not. These datas are important when we make or choose the steels, where the phosphide segregation stopping our possibilities.

Keywords : phosphorous, steel, segregation, thermo-calc software
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