Predicting Carbon Profiles in Carburized Steel Using Thermodynamic Calculations

Yasushi HIRAOKA※

Abstract

A prediction method for carbon profiles in a carburized steel was developed using the carbon diffusion model employing thermodynamic data calculated by Pandat software with the thermodynamic database PanFe8. In the thermodynamic data calculated by Pandat, the surface carbon concentration was calculated based on the carbon potential (CP), the temperature, the steel composition in atmospheric gas carburizing, while the carbon concentration in the matrix (austenite) and cementite was also calculated based on the temperature and the steel composition in vacuum carburizing. Based on these calculated thermodynamic data, carbon diffusion in steel was numerically calculated by solving Fick's second law under a surface boundary condition. Namely, carbon flux from the specimen surface of which the mass trausfer coefficient of carbon is a fitting parameter was considered in atmospheric gas carburizing. In vacuum carburizing the local equilibrium between the steel and graphite is achieved in the steel surface in the carburizing stage while mass transfer in the steel surface is ignored in the diffusion stage. The calculation results for both atmospheric gas carburizing and vacuum carburizing were in good agreement with the measured results for carburized JIS-SCr 420 steels.

※Senior Manager, Technical Center, Parker Netsusyori Kogyo Co., Ltd.