Modeling and Verification of Simulation Tools for Carburizing and Carbonitriding

Abstract

The Center for Heat Treating Excellence (CHTE) surface hardening simulation tools, CarbTool© and CarbonitrideTool©, have been enhanced to improve the accuracy of the simulation and to predict the microstructure and microhardness. These tools simulate both gas and low pressure processes. CarbTool© was enhanced by modifying the boundary condition. Carbon deposit and carbides formed during the boost step were studied. Nominate carbon potential was proposed for the simulation. Mass transfer coefficient was calculated. The microstructure and microhardness prediction were developed for both CarbTool© and CarbonitrideTool©. Retained Austenite fraction was predicted and used for input condition of hardness prediction. Magnetic Barkhausen Noise (MBN) was studied as an effective nondestructive testing method for surface hardness and case depth. The correlation between the MBN and the microstructure was well studied. Verification of the testing method was applied.