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## **Mathematical modelling and experimental investigation of carburizing steel**

In this study the result of the mathematical modelling and real heat treatment of alloyed steel were compared. Pack carburizing heat treatment of low carbon 16MnCr5 (BC 3) alloy steel was examined. The effects of heat-treatment process parameters on the microstructure, hardness, and malleability of a carburized sample made of steel 16MnCr5 has been determined using DEFORM software. The simulations provide a detailed view of the phase transfer, heat transfer, and carburized layer and its effect on the surface hardness that occurs during heat treatment to the sample (cylinder sample and Gear tooth sample). These simulations help to see the changes that happen during the whole process. Long carburization process (26.5 hours) was applied in both cases, mathematical modelling and real heat treatment. It contains three stages (carburization, austenitization, and tempering). After the process the samples were undergo on metallography sample preparation, that followed micro structure analysis and micro hardness test were made as a function of the distance from the treated surface. It was found that the real heat treatment and the mathematical modelling of the cylinder sample provide similar results in case of the measured hardness distribution and microstructure. The results showed that the carburized depth is more than 2.2 mm which has a large quantity of martensite. The hardness of the carburized layer at the surface is around HV0.2 800 and gradually decreased as the carbon content decreased getting farther from the surface.