

Abstract

With the current tough economic times and depressed commodity prices, focus is being placed on achieving higher power densities in gears without increased cost or reduced achievable life and reliability. An investigation into the use of different carburisation methods and processes to minimise post heat treatment distortion, with the aim to reduce and even eliminate the requirement for post heat treatment grinding and grinding stock allowances is presented. The investigation included the processing of test pieces, as per the recommendations of *AGMA 2004-B89: Gear Materials, Heat Treatment and Processing Manual*. Four alloy steels, namely AISI 3310, AISI 8620, AISI 9310 and 17CrNiMo6, were selected for this research, based on availability, cost and hardenability. The carburising cycles were derived for both gas and vacuum carburising for a 0.10% and 0.20% carbon steel respectively. Two quenching options were applied, oil quenching and intensive quenching. The test pieces were 3-dimensionally measured to determine distortion through the changes in diameter and ovality. The microstructures of the case and core were analysed, as well as effective case depth. This research found that current methods, atmospheric carburising and oil quenching, and steel alloy combinations are inadequate to produce low distortion carburised internal gears, while the use of vacuum carburising and intensive quenching as a process combination can achieve such gears. It was also found that the use of AISI 3310, performed the best for both current and proposed process combinations. It is recommended that future work be conducted, including a full-scaled manufacturing trial with more detailed process adjustments to ensure the quality and repeatability of the final carburised gear.