

Introduction

The Steel Market Development Institute's Bar Machinability Sub-committee was formed in 1991 to develop a database of automotive bar steel machinability under single point carbide turning conditions. To accomplish this task more than 30 industrially significant steel grades and their variants have been evaluated in the ensuing years. The test materials were produced by eight different steel companies using various melting and casting practices. Material properties and microstructures were characterized and the machinability of each steel variant was evaluated by at least two different machinability testing laboratories. A study of the machinability of more than thirty industrially significant carbon, alloy, resulfurized and microalloyed steel grades using carbide tools in a standardized single point turning test was conducted. It was found that machining data generated with high speed steel tooling could not be directly extrapolated to applications involving carbide tooling. The plain carbon and alloy steels were found to have a V30 tool life that correlated well with their Ito-Bessyo Carbon Equivalent when fitted to a 3rd order polynomial. It was also found that the machinability of 1200 series, 1100 series, microalloyed and leaded steels followed the same relationship. The Table 1 V30 values generated in this study can be used for guidance in selecting machining parameters for the steel grades tested. The V30 tool life of other steel grades can be approximated by calculating their Ito-Bessyo Carbon Equivalent and plotting it on the graph in Figure X of this document. The data base thus generated can be used by the machining industry to compare the relative machinability of various steel grades and their properties to make more informed materials application decisions.

Test Procedure

In establishing a machinability test standard, a number of factors were considered based on the discussions of the AISI Machinability Roundtable participants. First, the test procedure must not be so complex that it discourages its use. The ISO 3685 standard is very complete and broad in covering essentially all aspects of single point turning. However, it was the general consensus of the committee that only those features of the ISO 3685 relating to turning tests conducted with carbide tooling be addressed in the current standard. The standard test must be easy to conduct, and the cutting conditions well-defined and clearly specified. A second concern was one of reliability and transportability of standard test data. This was addressed in a round-robin series of turning tests conducted with SAE1141, SAE1541 and SAE4140. The preliminary tests established the reproducibility of the testing based on the proposed standard. To insure this level of reproducibility continued between the different testing laboratories, a standard baseline material (SAE1045) was selected as a reference. All participating laboratories conducted the standard turning test on this material.