

## A COMPARATIVE EVALUATION OF LUBRICANTS FOR FERROUS STRUCTURAL ALLOYS

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### Abstract

The use of lubricants in powder metallurgy is well established for minimizing die wear and aiding powder handling. The effect of a lubricant can extend to the green and sintered properties, including strength and dimensional control. In the past, various comparisons have been presented among lubricants; however, the comparison is often restricted to a small number of samples processed under laboratory conditions. In this study, a performance evaluation was conducted using a statistical experimental design with three premixed lubricants (Acrawax® C at 0.75 wt.%, Glycolube® PM-100 at 0.50 and 0.75 wt.%, and Lubrazinc® W zinc stearate at 0.75 wt.%). These combinations were selected based on earlier testing involving several lubricants at concentrations ranging from 0.25 to 1.00 wt.%. The lubricants were applied to a conventional ferrous alloy (FC-0208) of 2 wt.% copper and 0.8 wt.% carbon, using a water atomized iron powder. Over 2000 transverse rupture bars were compacted at 414 MPa (30 tsi) in an instrumented press and sintered in a belt furnace with an endothermic atmosphere at 1120°C (2050°F) for 30 minutes. Measurements conducted during the evaluation included ejection force, green density, green strength, sintered strength, sintered density, dimensional change, microstructure, and sintered hardness.

There were significant lubricant effects on the mean properties; however, there were few lubricant effects on the variance in the properties. These results were generally independent of sequence in both the pressing and sintering cycles, although a sintering day effect is noted. The statistical analysis shows Glycolube® PM-100 at a concentration of 0.50 wt.% to be superior for this alloy. This finding results from the lower ejection force and higher green density with this lubricant, resulting in higher sintered densities, higher strengths (green and sintered) and less dimensional change during sintering.