A Comparison of the Mechanical Properties and Production of Powder Metal Components made with Intralube® E and Sintered Using Two Different Sintering Approaches.

Scot E. Coble[1], Jacob P. Feldbauer[1],
Amber Tims, PMT[2], and Stephen L. Feldbauer, Ph.D.[3]

[1]The Pennsylvania State University, DuBois Campus, DuBois, PA 15801
[2]North American Hoganas Co., Hollsopple, PA 15935,
[3]Abbott Furnace Company, St. Marys, PA 15857

Abstract

Lubricant removal continues to be a challenging step in the production of powder metal components. Industry continues to see a demand for higher density compacts, which makes lubricant removal even more challenging. For these reasons the lubricant system Intralube® E sees regular use in the compaction of higher density powder metal components. Intralube® E is designed to help a producer achieve higher density compacts, improve ejection properties, while burning off cleanly (Hoganas AB, 2012).

The recent development of a new process (the Vulcan Process™) is resulting in a paradigm shift in the way lubricant removal is being addressed. The new process focuses on lubricant removal but the data shows that it provides an improved product. Intralube® E containing components sintered in the single stack loading condition in the new process have increased physical properties. Transverse Rupture Strength (TRS) are increased up to 12.6%, Rockwell B hardness (HRB) increased up to 7.9%, and for the 7.0 g/cm^3, 0.50 wt% samples density is increased by 0.2%, when compared to components sintered in a conventional sintering process.

Introduction

As seen in work pertaining to the lubricant type Acrawax® C (EBS) by Coble, Feldbauer, Tims, Stringer, and Feldbauer, the new process demonstrated the ability to remove all the lubricant from the compact. The result of total lubricant removal is the increase of physical properties of the sintered part. The study also showed that for an EBS lubricant system the performance of the new process demonstrated a significant opportunity to reduce the cost of production without compromising quality (Coble, Feldbauer, Tims, Stringer, & Feldbauer, 2022).

Moving forward with the study, producers, and the industry overall, are working to achieve higher green densities, 7.0 g/cm^3 and above. The increase in density enables the final component to have improved physical and magnetic properties. However, higher green densities propose challenges for producers. They require increases of compaction pressures and ejection energies as well as add difficulty to de-lubrication. As a result, producers, and the industry in general, seek advantages that can aid them in overcoming these challenges.

For these reasons, Intralube® E is seeing regular use. Intralube® E is a zinc-free lubricant that offers up to 20% better lubricant properties compared to a standard premix. The better lubricant properties allow for a producer to achieve higher green density, with the same compaction pressures, see Figure 1, or decrease ejection energy, see Figure 2. Hoganas AB reports that Intralube® E can further enhance density and ejection properties with warm die compaction. Intralube® E burns clean, thus decreasing the staining of sintered components (Hoganas AB, 2012).