A Fabricator Views Materials for Structural Parts

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The two obvious points of view one might discuss from the title of this paper are: 1) the impact of metal powders upon the processing steps from powder to finished parts, 2) the impact of metal powders upon the final properties of finished parts.

In discussing the first viewpoint, that of the influence of powders upon the processing or manufacturing steps we should include at least the following characteristics of metal powders which must be evaluated and controlled.

1. Flow rate
2. Particle size, shape, etc.
3. Apparent density
4. Compressibility
5. Compression ratio
6. Green strength
7. Sintering size change

The importance of making the correct selection of metal powders from which to manufacture a part is one of the major decisions the fabricator of structural parts has to make. The reason for this is based on the influence of the different metal powders upon the process, i.e., compacting, sintering, etc. and upon the final dimensions and properties. We expect greater dimensional control in the sintering of ferrous alloys and therefore accept and plan for rather closely held dimensional tolerances. Whereas, with the nonferrous powders we generally require greater dimensional tolerances due to size change as a result of the sintering cycle. In this paper we will confine our remarks to ferrous powders.

From a fabricator's viewpoint the major criterion of the suitability and the quality of the given powder for a specific part is measured by the uniformity of the powder from lot to lot as measured by these several factors. As a fabricator we do not attempt to determine why a given type of powder varies with respect to these seven factors, we only attempt to measure the percentage by which the powder varies and then try to get the producer or powder supplier to recognize our problem. Flow rate, apparent density, compression ratio, and green strength play their role in the filling of a die cavity and the compacting of a specific geometric body with a resulting green strength, and are extremely important to the success of the compacting operation.

Flow Rate

A powder with the maximum flow rate, particularly after blending with lubricant, graphite, etc., is very important to the success of rapid filling of die or mold cavities. Powders that flow freely allow faster press operation and insure uniform filling of the die cavity which results in much better control of the compacted density of the part. As we know there is quite a difference between the behavior of metal powder flowing through a controlled test such as the Hall flowmeter funnel and the flow behavior of the powder