A New Look at Hardness-Strength Relationships in Sintered Metals

R. Talmage
Consultant in Powder Metallurgy
New Canaan, Conn.

In the development of sintered metal parts over the past several years, hardness tests have been made and readings recorded whenever physical properties were measured. Their value has been considered dubious, however, because the readings were always low and their dispersion was relatively large when compared to conventional solid metals. This has particularly been the case since the development of the higher carbon content sintered steels. This paper will deal particularly with relationships in such sintered steels but the considerations are applicable to other sintered metals, also.

The normal indentation hardness test is of great value when properly understood, and can be the most valuable, reliable and important test of any of the mechanical properties, instead of being just a questionable measurement of the wear resistance. It can actually measure the density, strength and uniformity of most sintered metals, when properly used, and it, therefore, can serve as an excellent non-destructive test.

The thing which has caused so many people, both inside and outside the industry, to discount the value of hardness tests, is an old problem to powder metallurgy; the lack of understanding of the basic difference between porous metal and solid metal. Ever since sintered iron and steel were introduced, less than twenty-five years ago, the industry has been plagued with problems caused by this lack of understanding. At that time there was a new physical property introduced to the steel industry, namely: *variable density*. Before this the properties of most steels could be accurately foretold, if just the analysis, heat treatment and cold work condition were known. Today it is also necessary and vitally important to specify the density.

The real problem caused by variable density is the difficulty in understanding its great influence on all the other mechanical properties, especially when the porous product often looks apparently solid. Everyone will agree that a porous part must be weaker, but the problem stems from