A Comparison of Torsion and Tensile Properties of P/M Steels

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Abstract

The National Center for Excellence in Metalworking Technology (NCEMT) is developing material property data for powder metallurgy (P/M) alloys. A test procedure to measure the shear modulus, shear yield and shear rupture strength in torsion has been developed and is presented. A comparison of shear yield and tensile yield values for Iron-Copper and Iron-Nickel powder metal alloys of different densities is presented. The Iron-Copper and Iron-Nickel P/M alloys include both the sintered and quenched and tempered states. The ratio of shear yield strength to tensile yield strength is 0.559 for the P/M alloys and is equivalent to the reported value of 0.557 for ingot cast and wrought alloys.

Introduction

Product designers sometimes require knowledge of the shear properties when choosing an engineering material for their product. For wrought alloys, designers usually do not resort to direct torsion or shear measurements, but rely on a function of the tensile values. Testing performed at the National Institute of Standards and Technology (NIST) has established that the ratio of the proportional limit in shear to the proportional limit in tension to be approximately 0.557 for wrought materials[1,2]. The behavior of P/M alloys in torsion and shear is not developed at this time.

The National Center for Excellence in Metalworking Technology (NCEMT) operated by Concurrent Technologies Corporation, Inc. (*CTC*) is addressing this issue. Under the PM Industry Standards Program, NCEMT is developing a test procedure and measuring the shear modulus, shear yield, and shear rupture strength of P/M alloys[3]. This paper presents the effects of sintered density and heat treatment on torsional strength of iron-nickel and iron-copper