PLANE BENDING FATIGUE TESTING OF FERROUS PM MATERIALS

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ABSTRACT

The typical fatigue endurance limit data in MPIF Standard 35–SP, *Materials Standards for PM Structural Parts*, were determined using stress-controlled rotating beam fatigue (RBF) testing under fully reversed stress conditions (R = -1). The test specimens used for this test method are machined in accordance with MPIF Standard Test Method 56 and are stress relieved and polished prior to testing to mitigate the presence of residual stresses that might affect the measured fatigue properties. The RBF test is limited to a single mean stress condition (R = -1) and does not enable the effect of mean stress to be determined. Plane bend fatigue testing, using test specimens specified in ISO 3928, can be performed at various mean stress levels. The test specimens can be produced directly by pressing and sintering eliminating the machining cost and the potential for residual stresses after machining. Specimens can be compacted to include a notch so the notch-sensitivity of the fatigue response may be evaluated. The Center for Powder Metallurgy Technology (CPMT) and the MPIF Standards Committee have jointly initiated a program to determine the plane bending fatigue performance of selected PM materials. The data will be included in the Engineering Information section of MPIF Standard 35–SP. Initially, testing will be conducted under stress control in fully reversed bending to determine the fatigue endurance limit of selected materials using the staircase method. The program will be expanded later to include tests at various mean stress levels, again with a focus on determining the endurance limit, with the aim of creating Haig diagrams to reflect the effect of mean stress on the fatigue performance of the materials. Initial tests on both a hybrid, sinter-hardenable alloy FLC2-4208, and a prealloyed material FL-5008 will be reported.

INTRODUCTION

Many service failures are the result of fatigue. Fatigue is the result of repeated or fluctuating stresses having a maximum value less than the tensile strength of the material. The *Engineering Information* section of MPIF Standard 35–SP, Materials Standards for PM Structural Parts, contains the following information on fatigue properties:[1]