A UNIQUE FORM FOR COPPER INFILTRATION – WROUGHT WIRE INFILTRANT

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ABSTRACT

As the PM industry continues to investigate new higher performance materials and processes, a re-examination of the copper infiltration process for high strength, as-sintered products is introduced using a new infiltrant form. A wrought copper alloy wire product has been shown to offer an excellent infiltration response for the FX-1008 copper infiltrated steel grade. A complete set of mechanical properties for several levels of infiltrant and skeletal densities are provided. Very high infiltrated densities (greater than 7.7 g/cm^3) were achieved for this 15% maximum copper grade. Comparisons are drawn with conventional compacted powder infiltrants as well as the properties reported in MPIF Standard 35 for this alloy. The advantages of using this wrought wire form for the copper infiltration process are also presented.

INTRODUCTION

Copper infiltration of porous ferrous compacts, also known as the iron matrix or skeleton, has been popular in the North American market for over 60 years as a method to reduce the porosity and increase the strength of PM steel components. In this process the porous ferrous compact is brought into intimate contact with a copper base alloy and the two components are sintered at a temperature whereby the copper alloy melts and infiltrates the porosity of the ferrous compact [Ref 1, 2, 3, 4]. The ferrous compact may be in the green or sintered condition. If in the green condition this process is known as one-step infiltration or "sintration". While better dimensional control is typically associated with the two-step infiltration process (sinter the ferrous compact first and then infiltrate) the one-step process is most popular for its lower processing cost. The copper infiltrant typically has been a specially formulated copper powder material compacted into the shape of a disc, wafer, slug or ring, suitably placed on the top or underneath the ferrous compact during sintering. The assembly is placed on a sinter tray, typically a graphite plate, to support the assembly and prevent molten copper from possibly dripping on the sintering belt and causing damage.

The molten copper is drawn into the interconnected pores of the ferrous matrix by capillary action. The capillary pressure varies inversely with pore diameter and indirectly with the surface energy of the