

A COMPARATIVE STUDY OF CONVENTIONAL AND ULTRASONIC GAS ATOMIZATION OF ALUMINUM ALLOYS

D.H. Ro and H. Sunwoo

**Imperial Clevite Technology Center
Cleveland, Ohio 44108**

Abstract

In the production of rapidly solidified metal powders, one way to increase the convective cooling rate is to decrease the particle size. Ultrasonic gas atomization has been claimed to produce finer particles which are generally less than 250 μm in diameter, and to be more energy efficient in comparison with conventional gas atomization. This paper presents preliminary results obtained from prealloyed powders of 7091 and aluminum-lead base alloys produced by ultrasonic and conventional gas atomization techniques. Light microscopy, scanning electron microscopy, and Auger electron spectroscopy techniques were employed to determine size, morphology, cooling rate, the degree of chemical homogeneity, and microstructure of powders. Fine, spherical particles are produced by ultrasonic atomization. Cooling rates, 10^3 to 10^5 $^\circ\text{K}/\text{sec}$, appear to be comparable in both conventional and ultrasonic processes. The implications of these findings are discussed in relation to some properties of subsequent consolidated products.

Introduction

Gas atomization processes for making aluminum alloy powders employ a fluid to disintegrate a continuous stream of liquid metal. The atomizing fluid can be air, flue gas or inert gases such as helium or argon. Depending upon the pressure of the fluid for atomization, the powder size can widely vary. Solidification in gas atomization processes is dominated by convective heat transfer, even though both radiative and conductive heat transfers also play roles. According to a simple, convective heat transfer model, the average cooling rate of the metal droplet formed during atomization is directly proportional to the heat transfer coefficient and inversely proportional to the size of the particle^(1,2). The heat transfer coefficient may be increased by increasing the velocity of the atomizing fluid.