LAMINAR SONIC AND SUPERSONIC GAS FLOW ATOMIZATION - THE NANOVAL PROCESS

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ABSTRACT

Conventional gas atomization processes use turbulent gas flows decelerating, whereas the melt stream accelerates. They yield powders of mean particle diameters d_{50} above 20 µm only, and their specific gas consumption is high. The NANOVAL process employs a strictly laminar gas flow, accelerating parallel to the melt stream. It gives much finer spherical metal powders at very narrow particle size distributions and substantially lower gas consumption rates. Highlighted successful applications and products so far are MIM, SMD solder pastes, thermal spraying, contact materials, dental amalgams, diamond tools, catalysts, and rapidly solidified (RS) materials.

INTRODUCTION

Gas atomizing processes for the production of coarse metal powders are well known since decades. Typically such powders have wide particle size distributions in their 'as atomized' state. Usually, the particle size distribution of a raw gas atomized powder can be approximated with a logarithmic normal distribution, characterized by its mean particle diameter d_{50} and its standard deviation σ. At 'classic' gas atomizing processes, mean particle diameters between 50 and 500 µm can be obtained with standard deviations of 3 and above. For most applications such broad range of particle size is not acceptable. Classification is the only way to adjust the particle size within desired limits. Often the sieving machines require more space in the powder factory than the atomizer does. The fine, undersize or often 'dust' called fraction, has often been handled as scrap material, as there had not been any application for it.

Meanwhile, a market for fine and ultrafine powders with mean particle sizes of 20 resp. 10 µm has developed rapidly. Such fine powders are available on the market in some alloy compositions, all derived from the production of coarse powders and are typical by-products. No