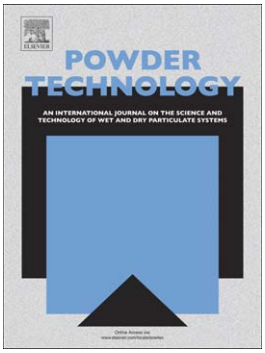

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Gas Mixture Detonation Method, a Novel Processing Technique for Metal Powder Compaction: Experimental Investigation and Empirical Modeling

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Abstract

High-velocity compaction of aluminum powders has been studied experimentally using a novel processing technique, called gas mixture detonation method. According to this new idea, 48 experiments have been carried out by gas detonation apparatus at four different total pre-detonation pressures of the gaseous mixture to achieve the maximum relative green density of 97.64%, the maximum relative green strength of 17.88%, and minimum porosity of 2.36%. The influences variables including initial powder masses, grain particle size distribution, and loading rate on green density, green strength, and porosity of products have been investigated in details. Also, an attempt has been made to empirically analyze the gas detonation compaction of powders based on dimensional analysis by suggesting new dimensionless numbers for this process. New dimensionless numbers have been suggested based on the effective parameters in gas detonation compaction process. Eventually, singular value decomposition method has been used as a new mathematical approach to obtain the empirical expressions for predicting the relative green density as well as the strength of products. Comparison between empirical and experimental results of the green density and strength illustrated remarkable agreement for all experiments.

Keywords: Empirical modeling, Gas detonation forming, High-velocity, Powder compaction.

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