Density Evolution Law in Compacting Molding Powder (Ⅰ): Construction of Loading Curve Equation

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Abstract: To evaluate the compressibility of modeling powders and determine the pressing process parameters economically and efficiently, a study on the density evolution law of modeling powder during loading was conducted. Firstly, two kinds of TATB based PBX-A and PBX-B modeling powders were taken as the research objects. Based on the normal temperature load-displacement data obtained under the three pressures, their respective pressure-density curves were obtained via transformation. Then, the loading curve equations for the two kinds of modeling powders were constructed by the Kawakita equation and Gerdemann-Jablonski equation used in powder metallurgy, respectively. Finally, the accuracy of the description of the two equations was evaluated, and their suitability for describing the density evolution law in the PBX molding powder pressing process was analyzed. The results show that both the Kawakita equation and the Gerdemann-Jablonski equation can all describe the density evolution cgaracteristics of PBX-A and PBX-B modeling powders in high accuracy. But in contrast, the Gerdemann-Jablonski equation is better than the Kawakita equation, the average relative error of two equations for the PBX-A modeling powder is 1.23% and 1.79% respectively, the average relative error of two equations for the PBX-B modeling powder is 0.95% and 1.57% respectively. Since the description accuracy of the Gerdemann-Jablonski equation is higher than that of the Kawakita equation, and the equation parameters can reflect the flow, rearrangement, and deformation characteristics during loading process, the physical meaning is more clear, therefore, it is more worthy of popularization and application.

Key words: polymer bonded explosives(PBX); loading curve; density; Kawakita equation; Gerdemann-Jablonski eqution

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