Consolidation Behavior of Metal Powder in Additive Manufacturing

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学 位 論 文 概 要

学位論文題名

Consolidation Behavior of Metal Powder in Additive Manufacturing

（和訳）

積層造形法による金属粉末の結合特性に関する研究

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学位論文概要

Additive manufacturing (AM) is a relatively new and emerging manufacturing technology that is able to revolutionize the manufacturing industry. This is due to its high flexibility in processing different types of material under various conditions. However, capability of a product to have desirable quality comparable to traditional processing techniques is still not achievable. Consolidation behavior and influences of processing parameters are important in determining the part quality. Therefore, in this research, consolidation behavior of metal powder was examined by monitoring the real time consolidation process and surface temperature. A high speed camera was utilized with telescopic lenses in order to monitor interaction of laser and material within the fusion zone (FZ). In order to investigate the consolidation temperature, a two-color pyrometer was used. The influences of the processing parameters were investigated. It was found the temperature and consolidation behavior were affected by the processing parameters. The line consolidation characteristics were analyzed according to the line consolidation width, FZ, melt pool and splattering behavior. Based on the study, the line consolidation can be classified into five different consolidation types. These types are continuous, discontinuous, ball shaped, weak and very little consolidation. The consolidation mechanisms that occurred during line and area consolidation were also reported. Other than that, the properties of the consolidated material were studied, and its potential for the development of permeable structure was investigated. It was found that the properties the structures developed via AM relatively good and feasible to be used for the manufacturing of injection mold.