

Powder Metallurgy of Rapid Manufacturing Processes

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Rapid manufacturing processes for metal parts have evolved during the past decade to provide interesting alternatives to conventional processes for part production. These direct metal processes can be classified as: (i) indirect layered – powder particles are assembled and bonded into a green part, then debonded, sintered and/or infiltrated; (ii) direct layered – powder particles are selectively sintered or melted directly into the finished part; (iii) direct deposition – powder particles are melted and deposited directly onto a substrate or previously deposited powder to form a part. While all of these processes necessarily start with metal powders, each of the process classes results in a different microstructure for the same starting alloy powder. For industrial applications of these technologies, it is vitally important to consider the metallurgical aspects of the processes and their influence on final part properties. In this presentation, the mechanics and mechanisms of each class of rapid manufacturing process will be reviewed, followed by description of the resulting microstructures and their effects on properties. Speculation is also given on future developments in rapid manufacturing processes, materials, design implications, and standards.