

Spark Plasma Sintering: A Useful Technique to Develop Large-Sized Bulk Metallic Glasses

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In summary, high heating rate (up to 1000 K min⁻¹), the effect of the current or electric field, and the application of pressure are mainly features of the spark plasma sintering technique.

Present Status

Since an economical SPS system has been developed, this process has become more attractive for the development of advanced materials and the sintering/synthesis of those materials that are very difficult to be sintered by the conventional sintering processes such as hot pressing and hot isostatic pressing processes. Using the spark plasma sintering process, pure metals, alloys, ceramics, polymers, composites, superconductors, thermoelectric materials, functionally graded materials (FGMs), and so on, have been produced. During the last 20 years, the number of papers related to sintering/synthesis of the materials by the SPS technique, as shown in Figure 3(a), exhibits an exponential increase. At present, about 500 papers per year are published. The data was collected from ISI Web of Knowledge.

Based on the features of the spark plasma sintering process, sintering/synthesis of the materials can be carried out at a lower temperature and in a shorter time than that by conventional sintering processes. Therefore, the SPS process is favored to sinter materials that need suppress crystallization and grain growth, such as metallic glasses and their composites. During the last 10 years, a large number of studies about consolidating metallic glasses and their composites by using the SPS process have been carried out. Figure 3(b) shows the number of papers associated

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