

A Study on Temperature Gradient in Die Mold during Spark Plasma Sintering Process

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Many research works on SPS (Spark-Plasma Sintering) reported that remarkable improvements in material properties can be obtained by this processing. It is because a consolidation at lower temperature for shorter period is possible in comparison with other conventional sintering methods. The reported material systems involve most of hard-to-sinter materials such as intermetallic compounds and refractory, high-performance engineering ceramics and their composites.

SPS is similar to a conventional electric-current sintering or hot-pressing. But it is different from them in the sense that the electric current is applied to a specimen in a form of pulse and the specimen is heated both by resistance heating of the specimen itself and the conductive die mold (usually graphite). Some works reported already that there is temperature difference between die mold and powder compact during SPS processing. It seems from the difference of electrical resistivity between them.

In this study temperature difference between die mold and powder compact was measured using various materials with different electrical resistivity such as Cu, Ni, TiNi, and zirconia. Temperature was measured at die hole, the border of die and powder compact, and powder compact, respectively. Temperature gradient was compared. Relationship between electrical resistivity and temperature gradient was discussed.

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