NJS Technical Information

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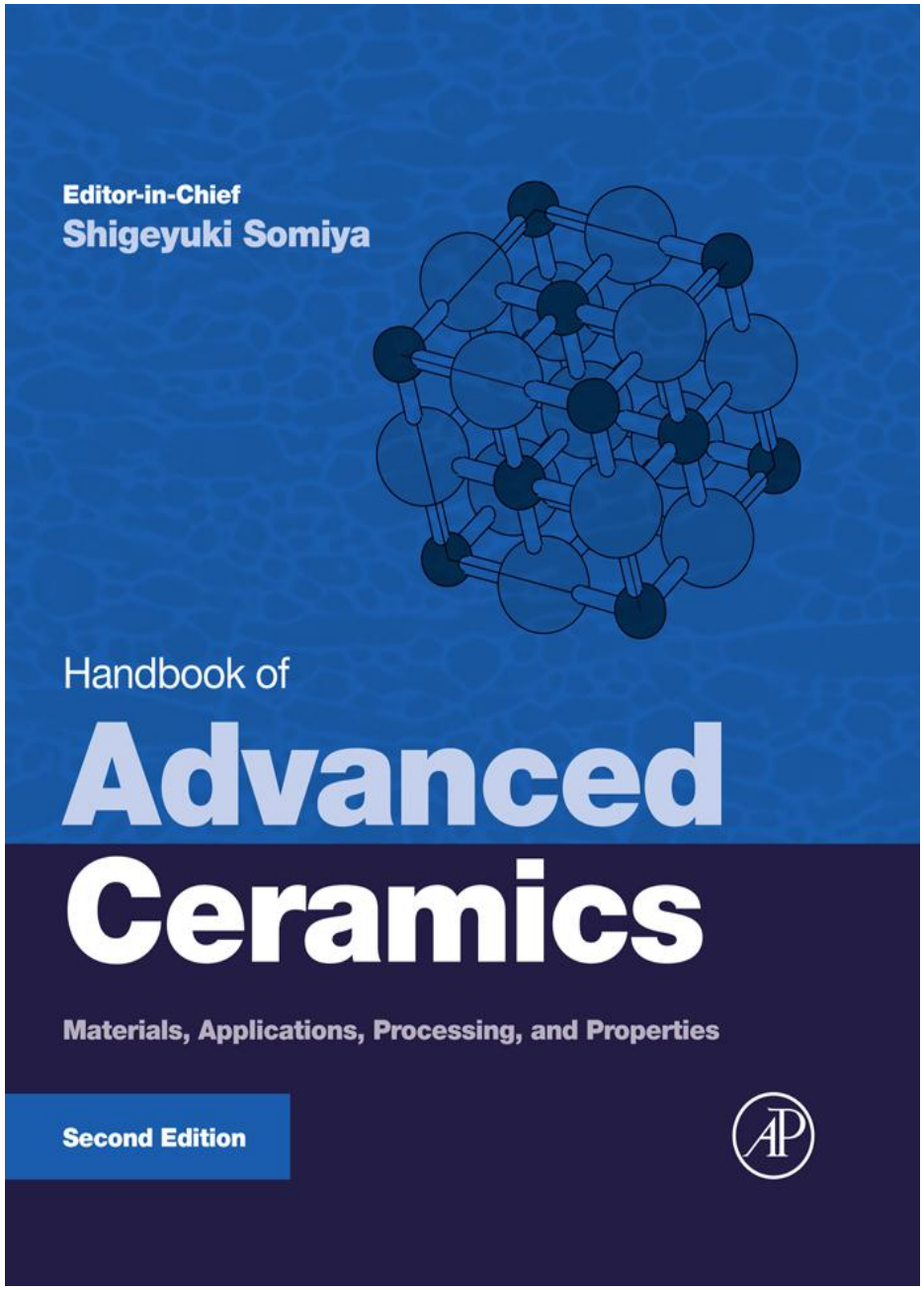

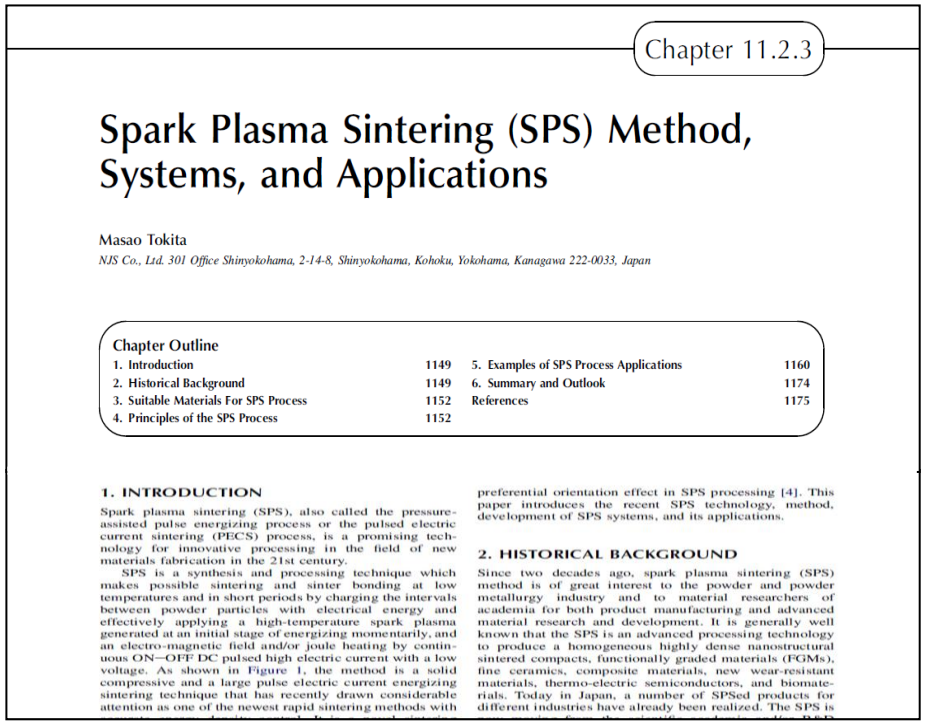

Chapter 11.2.3

Spark Plasma Sintering (SPS) Method, Systems, and Applications

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Chapter Outline

1. INTRODUCTION

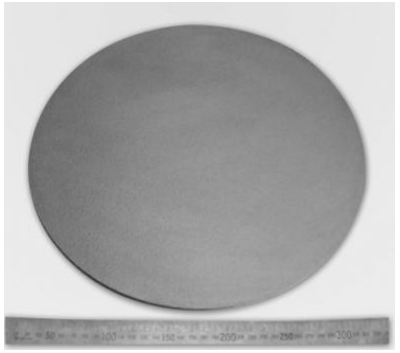
Spark plasma sintering (SPS), also called the pressure-assisted pulse energizing process or the pulsed electric current sintering (PECS) process, is a promising technology for innovative processing in the field of new materials fabrication in the 21st century.

SPS is a synthesis and processing technique which makes possible sintering and sinter bonding at low temperatures and in short periods by charging the intervals between powder particles with electrical energy and effectively applying a high-temperature spark plasma generated at an initial stage of energizing momentarily, and an electro-magnetic field and/or joule heating by continuous ON–OFF DC pulsed high electric current with a low voltage. As shown in Figure 1, the method is a solid compressive and a large pulse electric current energizing sintering technique that has recently drawn considerable attention as one of the newest rapid sintering methods with

preferential orientation effect in SPS processing [4]. This paper introduces the recent SPS technology, method, development of SPS systems, and its applications.

2. HISTORICAL BACKGROUND

Since two decades ago, spark plasma sintering (SPS) method is of great interest to the powder and powder metallurgy industry and to material researchers of academia for both product manufacturing and advanced material research and development. It is generally well known that the SPS is an advanced processing technology to produce a homogeneous highly dense nanostructural sintered compacts, functionally graded materials (FGMs), fine ceramics, composite materials, new wear-resistant materials, thermo-electric semiconductors, and biomaterials. Today in Japan, a number of SPSed products for different industries have already been realized. The SPS is



SPS Job-shop center in Japan (left/3MN right/200KN)

φ300mm large Al_2O_3 SPSed compact(Relative density:98%)