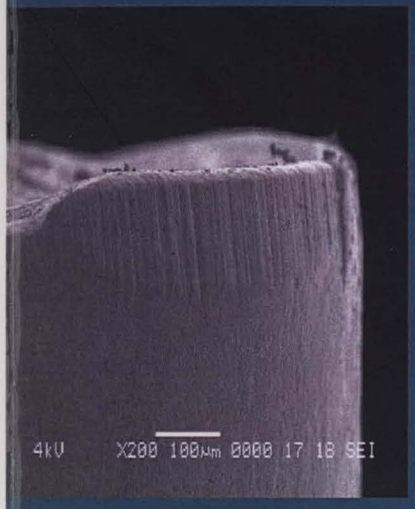

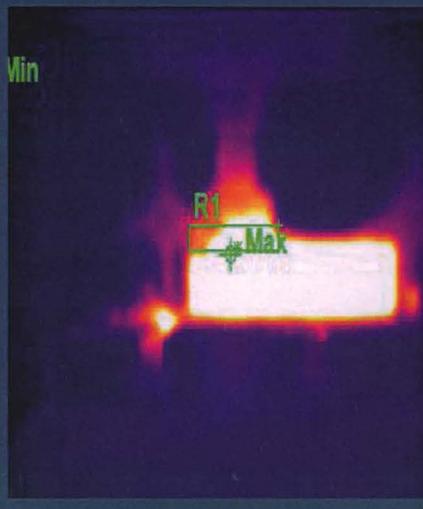

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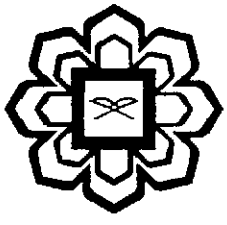

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Chapter 21

Microwave Sintering of Metallic Materials

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1. Introduction

Since 1984, the Materials Research Institute at The Pennsylvania State University has been a pioneer institution in the microwave processing of a whole range of ceramics, composites, and metallic materials. The 1980s saw successes in sintering and synthesizing of many traditional ceramics such as alumina, zirconia, ZnO, [NZP], hydroxyapatite, zeolites, mullite, silica, etc. The focus in the 1990s was aimed at new materials and in new directions [1]. Metallic materials in a powdered or unsintered form, will couple in a microwave field efficiently and effectively to produce highly sintered bodies with improved mechanical properties [2,3]. Roy *et al.* [4] discussed the use of microwave sintering and noted that few experiments have been done with metal powders. Green laboratory and commercial compacts were microwave sintered, typically, at 1100°C to 1300°C for 5 to 30 minutes. The sintered compacts were reported to have uniformly distributed porosity with improved properties in comparison with conventionally processed materials.

2. The Microwave Sintering of Metallic Materials

Microwave sintering has been extensively used for the consolidation of ceramics and hard metals [5 - 10]. Roy *et al.* [4, 11] were the first to prove that metallic materials can be coupled with microwaves as long as they are in powder form. Rodiger *et al.* [10] reported that sintering of hardmetal with microwaves leads to a finer microstructure because of lower sintering temperatures and shorter processing times compared to conventional sintering. A more recent sintering of premixed and pre-alloyed Cu-12Sn bronze for temperatures corresponding to transient, solid-state, and supersolidus sintering were done by Sethi, Upadhyaya and Agrawal [12]. The study has shown that the hardness of the premixed microwave samples is higher than for the corresponding conventional premixed samples. In addition, the microstructure in the case of microwave sintered samples is more uniform than the conventionally sintered ones.