

# **Research on Millimeter-Wave/Microwave and Pulsed High Current Processing of Materials in Japan**

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## **ABSTRACT**

Recent progress of materials processing in Japan is briefly described based on the application of millimeter-wave/microwave and pulsed high current energies, where results conducted at JWRI, Osaka University are mainly presented. This type of processing has been studied extensively in Japan with a name of "electromagnetic energy processing of materials" under a similar concept of dynamic energy transfer to the materials in addition to simple materials heating. Materials based on ceramics and their composites are considered to be directly heated from inside with high heating rate and short period in comparison with that of conventional electric furnace. An important factor with a name of "nonthermal effect" in this processing is shortly discussed and experimental results on sintering of various ceramics are described. Firstly several unique characteristics of electromagnetic energy sintering of ceramics are demonstrated with a special emphasis on the millimeter-wave processing. Secondly sintering of pure  $\text{Al}_2\text{O}_3$ ,  $\text{Si}_3\text{N}_4$  and  $\text{AlN}$  by millimeter-wave heating are indicated and thirdly that of  $\text{Al}_2\text{O}_3$ ,  $\text{BaTiO}_3$  and  $\text{TiO}_2$  by pulsed high current heating is also described. In the millimeter wave processing, unique features induced by selective heating are especially demonstrated, while in the pulsed high current heating unique properties induced from high current supply are explained briefly. Next step and future demand is also given in conclusion.