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## **In situ synthesis of ZrB<sub>2</sub> in Al matrix by reactive spark plasma sintering of mechanically alloyed powder**

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**Abstract:** Spark plasma sintering was utilized to synthesize in situ Al-ZrB<sub>2</sub> nanocomposite from reactive powders.

Reactive powder mixtures of Al-ZrO<sub>2</sub>-B<sub>2</sub>O<sub>3</sub>-B were prepared by mechanical alloying (MA) in a high energy planetary ball mill. Initial powder mixtures were milled for 30 h at 450 rpm and 20 h at 600 rpm milling speeds to prevent SHS reaction and formation of ZrB<sub>2</sub> during mechanical alloying. Reactive powders were sintered successfully by spark plasma sintering at 550 °C for a sintering time of 10 min. X-ray diffractometry (XRD) was used to study the structural evolution during milling and after sintering. Powder particles and sintered samples were examined by scanning electron microscopy (SEM) for microstructural investigations. Hardness measurements were conducted on the cross section of sintered samples. Sintering of reactive powders led to in situ formation of ZrB<sub>2</sub> nano particles within the Al matrix. The hardness of SPSed nanocomposites obtained from reactive MAed powders was measured to be 240 HV with a reasonable density.

**Keywords:** “In situ composite; Spark plasma sintering; Al-ZrB<sub>2</sub>”