Effect of Mo-Si molar ratio on the Synthesis of MoSi2 through Mechanical Alloying.

Abstract

In this work, mechanical alloying (MA) technique, which involves repeated cold welding, fracturing and re-cold welding of powder particles, was used to produce molybdenum disilicide ($MoSi_2$) starting from elemental powder mixtures of Mo and Si. The effects of composition of starting materials on the formation mechanism and phase formation were investigated. Two different molar ratios of Mo: 3Si and Mo:4Si were prepared in addition to the stoichiometric powder mixture Mo:2Si. Intermittent sampling was done from 4 to 20 h. Samples were characterized by using X-ray diffraction (XRD)/scanning electron microscopy analyses and crystallite size calculated was based on the conventional Scherrer method. With stoichiometric powder mixture, $MoSi_2$ was synthesized based on the mechanism of mechanically induced self-propagating reaction (MSR). Increasing Si content **clearly delayed the** MSR and the reactants were gradually converted to both α-$MoSi_2$ and β-$MoSi_2$ phases over a relatively long time. Agglomeration was noticed in samples, even though with different extents. The samples were then heat-treated at 900°C. The phase transformation and crystallite size evolutions of the heat-treated powders were characterized by XRD. Final product of Mo:2Si mixture included Mo_5Si_3 compound, while for other compositions with extra Si the final product was α-$MoSi_2$ and the excess Si.

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