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W含量对$(Mo_{1-x}, W_x)Si_2$复合材料力学性能和高温氧化性能的影响

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摘 要： 以Mo、W和Si粉为原料，采用自蔓延热爆合成和热压工艺制备不同W含量的$(Mo_{1-x}, W_x)Si_2$复合材料，研究W含量对$(Mo_{1-x}, W_x)Si_2$复合材料的力学性能和高温抗氧化性能的影响。结果表明：随着W含量的增加，$(Mo_{1-x}, W_x)Si_2$复合材料的力学性能逐渐增加，氧化激活能逐渐降低；$(Mo_{0.5}, W_{0.5})Si_2$复合材料的室温抗弯强度、 1 200 ℃高温抗弯强度、硬度和断裂韧性分别为363 MPa、480 MPa、9.28 GPa和3.82 $MPa·m^{1/2}$，与纯$MoSi_2$比较，分别增加了40.7%、112.4%、12.1%和27.3%；$(Mo_{1-x}, W_x)Si_2$复合材料在1 673~1 873 K空气中能形成致密的氧化层，氧化增量符合抛物线规律。

关键字： 二硅化钼；合金化；力学性能；氧化行为

Effect of W content on mechanical properties and high temperature oxidation behavior of $(Mo_{1-x}, W_x)Si_2$ composites

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Abstract: $(Mo_{1-x}, W_x)Si_2$ composites were prepared by the thermal explosion mode of SHS followed by hot pressing using Mo, W and Si powders as raw materials. The effect of W content on the mechanical properties and high temperature oxidation behavior of $(Mo_{1-x}, W_x)Si_2$ composites were studied. The results show that with increasing W content, the mechanical properties of $(Mo_{1-x}, W_x)Si_2$ composites gradually increase, and the activation energies of $(Mo_{1-x}, W_x)Si_2$ composites gradually decrease. The room temperature bending strength, high-temperature flexural strength at 1 200 ℃, hardness and fracture toughness of $(Mo_{0.5}, W_{0.5})Si_2$ composite are 363 MPa, 480 MPa, 9.28 GPa and 3.82 $MPa·m^{1/2}$,

respectively, increased by 40.7%, 112.4%, 12.1% and 27.3% when compared with those of the monolithic $MoSi_2$. $(Mo_{1-x}, W_x)Si_2$ composites can form compact oxidation layers in the air at 1673−1 873 K, and oxidation mass gain is accordance with parabolic law.

Key words: molybdenum disilicide; alloying; mechanical properties; oxidation behavior