A novel wear-resistant CoCrW-based alloy via heterogeneous deformation induced by carbides growth

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Abstract A novel heterogeneous deformation CoCrW-based alloy with B_4C addition is prepared via spark plasma sintering. Due to the decomposition of B_4C[1-3] and the solid solution of C and B elements during sintering, the size of primary Cr_7C_3 in the alloy grows, and the fracture mechanism changes from intergranular fracture to transgranular fracture, achieving high strength of 2535 MPa. Meanwhile, the large-size carbides absorb the frictional shear work by generating cracks, avoiding severe plastic deformation on the worn subsurface. At high temperature, the high strength alloy provides better support for the formation and stabilization of the glaze layer. As a result, the novel CoCrW-based alloy obtains excellent tribological properties with low wear rates of 1.31×10^{-5} and 6.5×10^{-6} $mm^3N^{-1}m^{-1}$ at room temperature and 700 ℃, respectively, accounting for only 49.6 and 33.7% of the of pure CoCrW alloy.

Keywords CoCrW alloy; heterogeneous deformation; tribological properties; spark plamsa sintering

Reference

[1] XU J Y, WU W Y, PENG K W, et al. Study of the performance and microstructure of CeB_6/B_4C ceramic composite via in-situ synthesis[J]. Journal of Rare Earth, 2007, 25: 468-472.

[2] JIANG D, CUI H Z, CHEN H, et al. Wear and corrosion properties of B_4C-added CoCrNiMo high-entropy alloy coatings with in-situ coherent ceramic[J]. Materials & design, 2021, 210: 110068.

[3] IGOR M, LARISSA G, JAN C, et al. Preparation and properties of medium entropy CoCrNi/boride metal matrix composite[J]. Journal of Alloys and Compounds, 2018, 748: 979-988.