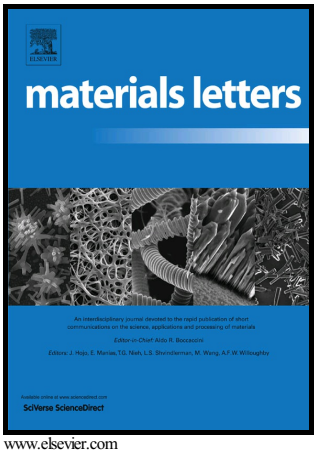

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Simultaneously increasing the strength and ductility of a refractory high-entropy alloy via grain refining

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Abstract

The HfNbTaTiZr refractory high-entropy alloy was investigated on the grain growth kinetics and tensile properties. Grain growth at 1200~1350 °C is rather slow. The activation energy is 389 kJ/mol and the growth exponent is 3.5. The HfNbTaTiZr alloy has high strength, small work hardening and high ductility. Grain refining is found to enhance the tensile strength and ductility simultaneously.

Keywords: Refractory high-entropy alloys; Metals and alloys; Recrystallization; solute-drag mechanism; Hall-Petch equation.

1. Introduction

A new alloy design strategy called high-entropy alloys (HEAs) has attracted significant attention in the past decade [1-4]. A subclass of HEAs, the refractory HEAs, is also of great interest [5, 6]. These alloys can have exceptional high-temperature strength and reasonable compressive plasticity. However, their tensile ductility at room temperature is a major concern. In this regard, the HfNbTaTiZr alloy is special because it has a very high compressive plasticity ($\varepsilon > 50\%$) at room temperature. Grain refining is considered as a route to improve the mechanical properties of metals and alloys [7]. Some literatures on CoCrFeMnNi