Study on preparation and property of porous tungsten via tape-casting

Qiang Shen, Dongqing Zhou, Jian Zhang, Guoqiang Luo, Lianmeng Zhang

PII: S0263-4368(17)30209-3
DOI: doi: 10.1016/j.ijrmhm.2017.07.018
Reference: RMHM 4488

To appear in: *International Journal of Refractory Metals and Hard Materials*

Received date: 3 April 2017
Revised date: 26 July 2017
Accepted date: 31 July 2017

Please cite this article as: Qiang Shen, Dongqing Zhou, Jian Zhang, Guoqiang Luo, Lianmeng Zhang , Study on preparation and property of porous tungsten via tape-casting, *International Journal of Refractory Metals and Hard Materials* (2017), doi: 10.1016/j.ijrmhm.2017.07.018

Study on preparation and property of porous tungsten via tape-casting

Qiang Shen, Dongqing Zhou, Jian Zhang*, Guoqiang Luo, Lianmeng Zhang

State Key Laboratory of Advanced Technology for Materials Synthesis and Processing, Wuhan University of Technology, Wuhan 430070, China

*Corresponding author. E-mail address: zhangjian178@whut.edu.cn (J. Zhang).

Abstract

A novel method of preparing porous tungsten via tape-casting is developed in this study. Micron-sized bulk porous tungsten with an open, biporous structure with large pores of 3-6 μm and with small pores of ~1 μm was successfully fabricated. The morphology of large pore depends on NaCl space-holder, and the uniform porous structure can be attributed to dispersant and binder added in tape-casting slurry which keeps tungsten powders decentralized, make the slurry stable and ordered. Compared with conventional process, the sintering temperature is reduced by at least 300°C with the help of exothermic carburization of tungsten where carbon is introduced in the process of removing organics. W_2C phase was in situ generated on the surface of W particle and became the boundary between W grains. Furthermore, tape-casting samples show typical compressive properties of brittle porous material with higher compressive strength, which is attributed to the hard phase (W_2C) and uniform porous structure.

Keywords: porous tungsten; tape-casting; microstructure; sintering; compressive property

1. Introduction

Tungsten owns the highest melting temperature, the lowest coefficient of thermal expansion and the highest tensile strength among all metals [1]. Hence, porous tungsten plays a leading role in high temperature and military applications such as high current density cathodes in high power lamps [2], engineering and structural material with excellent dynamic compressive properties [3]. Moreover, it is widely used as scaffolds for tungsten based metal–metal and ceramic–metal composites manufactured