Accepted Manuscript

Chromium silicide-based composites fabricated via solid-state reactions: Phase development, oxidation behavior and electrical properties at high-temperatures

Gunes A. Yakaboylu, Katarzyna Sabolsky, Edward M. Sabolsky

PII: S0925-8388(18)32754-3

DOI: 10.1016/j.jallcom.2018.07.253

Reference: JALCOM 46969

To appear in: *Journal of Alloys and Compounds*

Received Date: 16 March 2018

Revised Date: 19 July 2018

Accepted Date: 23 July 2018

Please cite this article as: G.A. Yakaboylu, K. Sabolsky, E.M. Sabolsky, Chromium silicide-based composites fabricated via solid-state reactions: Phase development, oxidation behavior and electrical properties at high-temperatures, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.07.253.

Chromium silicide-based composites fabricated via solid-state reactions: Phase development, oxidation behavior and electrical properties at high-temperatures

Gunes A. Yakaboylu [a], Katarzyna Sabolsky [a], Edward M. Sabolsky [a,*]

[a] Department of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, USA

* Corresponding author at: Department of Mechanical and Aerospace Engineering, West Virginia University, 395 Evansdale Drive, Morgantown, WV 26506, USA. E-mail address: ed.sabolsky@mail.wvu.edu (E.M. Sabolsky), Telephone: 304-293-3272, Fax: 304-293-6689.

E-mail addresses: gayakaboylu@mix.wvu.edu (G.A. Yakaboylu), kathy.sabolsky@mail.wvu.edu (K. Sabolsky)

Abstract

The chromium silicide-based electroconductive composites were fabricated by solid-state sintering of chromium silicide and chromium oxide powders at 1370°C in argon. The final densified composites were composed of various solid solution and silicide phases (e.g. Cr_3Si, Cr_5Si_3) and silica, depending on the starting silicide/oxide volume ratio ranging from 0.67 to 9.0. Major phases were found to be homogeneously distributed within the metastable (cristobalite) and/or amorphous silica grain boundary phase. The controlled oxidation experiments revealed excellent oxidation resistance at 50°-870°C, where low-level oxidation was observed. The composites all displayed a metallic-type electrical conductivity due to the presence of the Cr_3Si, Cr_5Si_3 and CrSi as the major conductive silicide phases. Their electrical conductivities ranged from 42.1 to 213.7 S/cm at 1000°C. High-temperature annealing of the composites resulted in phase and microstructural changes, which further improved their high-temperature oxidation resistance and electrical transport properties.

Keywords: composite materials, intermetallics, solid state reactions, electrical transport, phase transitions, microstructure