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Effect of CeO2 Nanoparticles on Interface of Cu/Al2O3 Ceramic Clad Composites

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Abstract

Cu/Al2O3 ceramic clad composites are widely used in electronic packaging and electrical contacts. However, the conductivity and strength of the interfacial layer are not fit for the demands. So CeO2 nanoparticles 24.3 nm in size, coated on Al2O3 ceramic, promote a novel CeO2–Cu2O–Cu system to improve the interfacial bonded strength. Results show that the atom content of O is increased to approximately 30% with the addition of CeO2 nanoparticles compared with the atom content without CeO2 in the interfacial layer of Cu/Al2O3 ceramic clad composites. CeO2 nanoparticles coated on the surface of Al2O3 ceramics can easily diffuse into the metallic Cu layer. CeO2 nanoparticles can accelerate to form the eutectic liquid of Cu2O–Cu as they have strong functions of storing and releasing O at an Ar pressure of 0.12 MPa. The addition of CeO2 nanoparticles is beneficial for promoting the bonded strength of the Cu/Al2O3 ceramic clad composites. The bonded strength of the interface coated with nanoparticles of CeO2 is increased to 20.8% compared with that without CeO2; moreover, the electric conductivity on the side of metallic Cu is 95% IACS. The study is of great significance for improving properties of Cu/Al2O3 ceramic clad composites.

Biography:

Yabo Fu, Ph.D, Main research directions: 1. Electromagnetic modification of copper, aluminum, titanium and its alloys and research and development of solid waste recycling; 2.2. Study on high strength and toughness titanium alloy and graphene aluminum;3. Research and application of high-strength and high-elasticity ti-copper, high-strength and high-conductivity chrome-zirconium copper, nano-alumina dispersion strengthened copper and high-strength and high-corrosion resistant white copper instead of beryllium bronze;4. Purification and homogenization technology of high-strength wear-resistant and corrosion-resistant aluminum bronze.More than 27 academic papers have been published, including 19 papers included by SCI/EI and 6 authorized invention patents.

The textbook practical course of nondestructive testing was published in June 2018.

Speaker Publications:

1. YaBo Fu, HaoNan Chen, ZhiQiang Cao and YanQiu Huo, Effect of CeO2 Nanoparticles on Interface of Cu/Al2O3 Ceramic Clad Composites, Materials 2020, 13, 1240; doi:10.3390/ma13051240, 2020.3.9
2. Yabo Fu, Shufeng Li, Jing Cui, and Ping Zhang. Al2O3 nanoparticles induced corrosion behavior of copper-based composites in a chloride environment, Science of Advanced Materials, 2018, 10(5): 718-723.
3. Yabo Fu*, Qinfa Pan, Zhiqiang Cao, ShufengLi ,Yanqiu Huo. Strength and electrical conductivity behavior of nanoparticles reaction on new alumina dispersion-strengthened copper alloy, Journal of Alloys and Compounds, 2019, 798: 616-621, 2019.08.25.
4. Ya-Bo Fu , Yi-Ping Lu, Zhi-Jun Wang, Zhi-Qiang Cao, Ai-Jiao Xu. Microstructural refinement and performance improvement of Cu–36 wt% Zn alloy by Al2O3 nanoparticles coupling electromagnetic stirring. Rare Metals, 2016, 9(67): 1-6, First online: 28 April 2016. Print ISSN 1001-0521, DOI 10.1007/s12598-016-0723-6.
5. Yabo Fu, Zhijun Wang, and Aijiao Xu. Al2O3 Nanoparticles Induced High Dezincification Corrosion Resistance of 71 wt.% Cu-Zn Alloy, Science of Advanced Materials,2015.12, 7(12):2570-2575.

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