Preparation and Application of Cu-Al Layered Composites

Qinghua Chang, Jingpei Xie, Chenhui He, Leyi Li and Yanfang Chen

ABSTRACT

The preparation and application of Cu-Al composite materials are introduced. The preparation methods are mainly divided into solid-solid complex method, liquid-solid complex method and liquid-liquid complex method. Applications include copper and aluminum joint material, copper and aluminum composite wire copper and aluminum composite strip.1

KEYWORDS

Cu-Al Composite, Rolling Compound, Double Crystal Continuous Casting, Electromagnetic Continuous casting

INTRODUCTION

Copper and aluminum composite materials not only copper excellent electrical conductivity, thermal conductivity, corrosion resistance, low resistance, beautiful appearance and other characteristics, as well as aluminum, light weight and other characteristics. At present, there is a serious shortage of copper resources in our country and its price is very expensive. However, due to its abundant aluminum resources and low prices, the copper and aluminum composite materials can be used to reduce the amount of copper used and meet the needs of various projects. It can

1Qinghua Chang, Jingpei Xie, Chenhui He, Leyi Li, Yanfang Chen. College of Materials Science and Engineering, Henan University of Science and Technology, Luoyang 471023, Henan, China, Collaborative Innovation Center of Non-Ferrous Materials, Luoyang 471023, China.
be widely used in electronic devices, Systems, construction, machinery vehicles, domestic appliances and other fields.

COPPER ALUMINUM COMPOSITE MATERIAL PREPARATION

Solid - Solid Phase Complex Method

(1) The hot-rolled composite [1-2] is a pressure-welding method in which the substrate and the composite periphery are overlapped and welded at a high temperature to make the contact surfaces diffuse to each other to complete the welding. The temperature of the hot-rolled composite method does not cause the matrix to overheat or melt, which leads to the deterioration of the material properties. However, during the hot rolling process, the production of metal compounds [3-5] will increase the brittleness and weaken the bonding strength, Material life shorter, inefficient.

(2) Cold-rolled composite method Compared with the hot-rolled composite method, the lower the temperature, to avoid the formation of metal materials are not conducive to the combination of phase transition, microstructure and brittle metal compounds.

Liquid - Solid Composite Method

As shown in Fig. 1, the crystallizers 4 and 10 are coaxial crystallizers and the mandrel metal solidifies in 4 into the outer layer of molten metal in the crucible 7. This method can make the metal bonding surface have stable performance and good structure. The advantages of this method are as follows: the process is simple, the interface of the composite is suitable for a wide range of applications, energy saving and consumption reduction.

Liquid - Liquid Complex Method

Electromagnetic continuous casting method is the production process as shown in Figure 2, Q1, Q2 by adding liquid metal, a magnetic field below the mold, Lorentz magnetic force on the two kinds of liquid metal to prevent the two mixed. The main advantage is the low cost, mass production, high composite density, combined with close, high bonding strength. Disadvantages Product size subject to certain restrictions.
COPPER AND ALUMINUM COMPOSITE MATERIALS APPLICATION

Copper-aluminum composite connector materials are widely used in refrigeration, electrical, petrochemical and other fields. In our country, the main method is the production of copper-aluminum composite joints by welding such as transitional layer welding, friction welding and pressure welding. The difference of performance between copper and aluminum limits the welding method [7-8]to a greater extent.

Copper-aluminum composite wire core is aluminum, the outer layer is copper or copper, with the development of the Internet, with high-quality copper clad aluminum wire coaxial cable has great potential for development [9]. At present, China is the most widely used cladding welding method, the production of copper clad aluminum wire better performance [10]. Another method is hydrostatic extrusion, first obtaining a strand blank and then effecting a metallurgical bond of copper and aluminum [11-12]using high hydrostatic pressure and large machining deformation rates.

Copper-aluminum composite strip is coated with a layer of copper on the surface of aluminum composite materials. Copper-aluminum composite panels with superior corrosion resistance, better heat ratio and a wide range of applicability has become the dominant radiator [13].

CONCLUSIONS

In summary, copper and aluminum composite materials in the power, electronics, information and other industries have a wide range of applications, The current production methods of copper and aluminum composite materials such as hot-rolled welding, etc., but each have some drawbacks, making some of the large-scale production has some difficulties. Therefore, the basic research of the composite material has important theoretical and practical significance.
ACKNOWLEDGEMENTS

This research was funded by (U160420059) the National Natural Science Foundation of China.

REFERENCES

1. Wang Mingzong, Zheng Hongzhu, Yao Liren. Study on thickness ratio and rolling force of aluminum-gold bimetallic composite rolling. Rolling, 1994 (6): 14 - 17.
2. Ghosh M.K., Pandey R.K., Singh P. Effect on the film thickness in high-speed lubricated cold rolling of a strip an inlet zone analysis. Proceedings of the Institution of Mechanical Engineers, 2003 (217): 155-165.
3. Yao Ruohao, Deng Hua, Yang Jianwu, etc. Copper-aluminum composite technology research. Shanghai Nonferrous Metals, 1999, 20 (3): 101 -
4. Deng Hua, Yao Ruohao, Yang Jianwu. Copper - aluminum composite technology research. Journal of Southern Institute of Metallurgy, 1997, 18 (2): 118 ~ 123.
5. Chen Y.C., Zhang Y.G., Chen C.Q. General theory of interdiffusion growth in diffusion couples. Materials Science and Engineering, 2004, 368 (1-2): 1-9.
6. Su Wen-ying, Yan Yu-qin, Ye Xi-qi. Studies on copper-aluminum flame brazing materials [J], Journal of Beijing University of Technology, 1994, 20 (4): 45-51.
7. Chongqing Institute of Welding. Cu-Al welding album [M], Chongqing: Metallurgical Industry Press, 1980.
8. Yang Rui-peng, Cai Wei, Li Pei-zu. Study on Direct Brazing of Aluminum and Copper [J], Welding Technology, 1999, 28 (5): 4-5.
9. Sundler, Wu Chunjing, Xie Jianxin, ladle aluminum composite wire manufacturing technology development status and prospects [J], wire and cable, 2003, (3) 3-6.
10. Sun Dele, Wu Chunjing, Xie Jianxin. Overview of metal composite wire forming process research and development [J], Materials Review, 2003, 17 (5): 65-68.
11. Gao Wenhao. Copper Clad Aluminum Standardization [J], Optical Fiber and Cable and Its Application Technology, 1999, (3): 23-27.
12. Hu Jie. Copper clad aluminum composite wire hydrostatic extrusion process [J], New Technology and New Technology, 2001, (9): 27-28.
13. Zhang Jian-chen, Zhou Zhi-gang, Yang Wen-bin. Research and development of new copper-aluminum explosion compound CPU heat sink [J], Computer Engineering and Applications, 2006 (34): 92-97.