中国有色金属学报
中国有色金属学报(英文版)
中国科学技术协会 主管
中国有色金属学会 主办

论文摘要

中国有色金属学报
ZHONGGUO YOUSEJINSHUXUEBAO XUEBAO
第17卷 第9期 (总第102期) 2007年9月

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文章编号：1004-0609(2007)09-1490-05

高能球磨对3%C-Cu粉末压制特性的影响

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摘 要：针对石墨/铜基复合材料存在烧结膨胀的特点，提出用粉末压制、真空热压烧结和热挤压相结合的致密化工艺。为给后续的烧结提供相对密度较高、质量好的冷压坯，采用刚性模常温单向压制方法研究高能球磨3%C-Cu(质量分数)粉末的压制压力与相对密度的关系，用黄培云压制理论考察球磨粉末的压制特性。用扫描电镜和场发射扫描电镜分别研究高能球磨粉末的微观组织和微区成分。结果表明，压制压力相同时，粉末压坯相对密度随高能球磨时间的延长而逐渐减小。高能球磨时间相同时，粉末压坯相对密度随压制压力的增加而增大。随着高能球磨时间的延长，粉末体越来越难压制。压制压力和保压时间分别为700 MPa和30 s时，所得粉末压坯的质量较好。

关键字： 3%C-Cu粉末；高能球磨；压制特性；相对密度

Effect of high-energy mechanical milling on cold compactability of 3%C-Cu powder

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Abstract: Aiming at intrinsic characteristics of sintering expansion for sintering billets, the process of powder compacting followed by vacuum hot pressed sintering and hot extrusion was put forward to densitify the composite powders. To provide higher relative density and high quality billets for subsequent sintering, the relation curves of pressed compacts prepared by high-energy mechanical milling 3%C-Cu (mass fraction) powders about relative density vs compacting pressure were achieved by means of one-direction pressing with rigid mould at room temperature. Cold compactability of these powders was investigated with HUANG Pei-yun's log-log powder compacting theory. Microstructures and microzone composition of high-energy mechanical milling 3%C-Cu powders were analyzed with scanning electron microscope and field emission scanning electron microscope. The results show that when the high-energy mechanical milling time increases, the relative density of pressed compact decreases gradually under the same compacting pressure. The relative density of pressed compacts, which were prepared by high-energy milling 3%C-Cu powders with the same high-energy mechanical milling time,

increases with increasing compacting pressure. It is more and more difficult for high-energy milling 3%C-Cu powders to be compacted when prolonging high-energy mechanical milling time. Pressed compacts with better quality can be obtained when compacting pressure and dwell time are 700 MPa and 30 s, respectively.

Key words: 3%C-Cu powder; high-energy mechanical milling; cold compactability; relative density