臺灣鑛業，第 66 卷第 2 期，第 46-53 頁，民國 103 年 6 月

以介相碳微球與黏結瀝青製備高密度石墨塊材

Fabrication of High-Density Graphite Blocks Using a Blend of Mesocarbon Microbeads and Binder Pitches

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摘　要

石墨塊材是工業與國防上重要的基礎材料，由煤焦油瀝青衍生而來的介相碳微球（mesocarbon microbeads）具有自黏性與高殘碳率，近年來廣泛被使用作石墨塊材之原材料。本研究以介相碳微球與一系列不同黏結劑含量之黏結瀝青進行熔融混摻，藉以調整介相碳微球之化學組成，以期利用調質後的介相碳微球製得高品質之石墨塊材。實驗結果顯示，隨著加入瀝青之黏結劑含量逐漸增加，調質粉體的黏結組成增加，粉體的微觀形態則由分散良好的顆粒轉變為團聚的碳微球。進一步將調質粉體以冷均壓方式成形後進行焙燒，結果發現當加入之黏結瀝青的組成落在特定範圍時(吡啶不溶物含量 10.3wt%，甲苯不溶物含量 63.4wt%)，所得調質粉體之燒結特性最好，其坯體經 2,750℃石墨化處理後完整未裂，且所得之石墨塊性質優良，密度可高達 1.93 g/cm^3，而孔隙度僅 9.3%。

關鍵詞：石墨塊材、介相碳微球、黏結瀝青。

Abstract

Graphite blocks have so many important applications in industries and the development of military equipment. Mesocarbon microbeads (MCMBs), derived from coal tar pitch, are intensively used as the raw materials for the manufacture of graphite blocks recently owing to their self-sinterability and a high amount of carbon residue. In order to acquire high-quality graphite blocks, commercial MCMBs were used and have been melt mixed with a series of binder pitches to adjust the MCMBs' chemical composition. With the increase of the binder content in the binder pitch, the binder composition of the modified MCMBs obviously increased. As for the morphology, the presence of the MCMBs was well dispersed microbeads while that of the modified MCMBs became aggregated microbeads due to the introduction of additional pitches. The modified MCMBs were subsequently subjected to compaction by cold isostatic pressing method and then to thermal treatments. It was evidently shown that as long as the added pitch possessed correct chemical composition (the quinoline insoluble fraction is 10.3 wt% and the toluene insoluble fraction is 63.4 wt%), the sintering property of the modified MCMBs could be significantly improved. After carbonization and then graphitization at 2,750℃, a high-quality graphite block was obtained. The resultant graphite block was intact without any craze, exhibiting an outstanding density of 1.93 g/cm^3 and a low porosity of 9.3%.

Key words: graphite blocks, mesocarbon microbeads, binder pitches.

103 年 1 月 20 日收件　103 年 5 月 16 日受理

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