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PII: S0925-8388(18)30924-1

DOI: 10.1016/j.jallcom.2018.03.065

Reference: JALCOM 45295

To appear in: *Journal of Alloys and Compounds*

Received Date: 10 November 2017

Revised Date: 25 February 2018

Accepted Date: 6 March 2018

Please cite this article as: Z. Chen, Y. Zhang, S. Wang, J.Y. Zhang, Q. Tao, P. Zhang, Microstructure and mechanical properties of undercooled $Fe_{80}C_5Si_{10}B_5$ eutectic alloy, *Journal of Alloys and Compounds* (2018), doi: 10.1016/j.jallcom.2018.03.065.

# Microstructure and mechanical properties of undercooled $Fe_{80}C_5Si_{10}B_5$ eutectic alloy

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**Abstract**: The $Fe_{80}C_5Si_{10}B_5$ alloy was investigated by means of fluxing and cyclic superheating. The microstructure of low undercooling range was quasi regular eutectic and complex rules eutectic; The structure of moderate undercooling corresponded to mixed eutectic and irregular eutectic; High undercooling resulted in the granular ferrite and irregular eutectic borides. There were two grain refinement processes within achieved undercoolings. The first grain refinement of irregular eutectic was related to oscillatory instability under non-equilibrium condition. The second grain refinement at large undercooling was caused by stress accumulation and break-up originating from the rapid solidification. With the increase of undercooling, the relationship between the microstructure and hardness including the size effect of crystal grain was systematically investigated. Meanwhile, the friction and wear performance of undercooled $Fe_{80}C_5Si_{10}B_5$ alloy was studied.

**Key words**: Undercooled solidification; $Fe_{80}C_5Si_{10}B_5$ alloy; Irregular eutectic; Hardness; Friction and wear

## 1. Introduction

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