

# Author's Accepted Manuscript

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N. Li, C.X. Cui, Y.Q. Zhao, Q.X. Zhang, L.N. Bai



PII: S0921-5093(18)31281-4  
DOI: <https://doi.org/10.1016/j.msea.2018.09.074>  
Reference: MSA36955

To appear in: *Materials Science & Engineering A*

Received date: 11 June 2018  
Revised date: 19 September 2018  
Accepted date: 20 September 2018

Cite this article as: N. Li, C.X. Cui, Y.Q. Zhao, Q.X. Zhang and L.N. Bai, Structure and properties of GCr15 modified by multiphase ceramic nanoparticles /Fe-C composite inoculants, *Materials Science & Engineering A*, <https://doi.org/10.1016/j.msea.2018.09.074>

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## Structure and properties of GCr15 modified by multiphase ceramic nanoparticles /Fe-C composite inoculants

N. Li, C.X. Cui\*, Y.Q. Zhao, Q.X. Zhang and L.N. Bai

Key Laboratory for New Type of Functional Materials in Hebei Province, School of Materials Science and Technology, Hebei University of Technology, No. 8, Road No.1, Dingzigu, Hongqiao District, Tianjin 300130, People's Republic of China

### Abstract

GCr15 Bearing steel is widely used in the manufacture of rolling bearings and rolling ring. So the microstructure and performance of bearing steel are critical to the proper functioning of bearings and equipment. The modification is one of the effective methods to improve the microstructure and performance of materials. In this paper, Fe-Nb-Cr-C amorphous nanocrystalline inoculants are prepared by *in-situ* synthesis and rapid solidification techniques. Then, the microstructure of Fe-Nb-Cr-C inoculants are observed and analyzed. It is indicated by the test results that a large number of ceramic particles are distributed in the matrix of inoculants homogeneously. This paper also describes the heterogeneous nucleation of ceramic nanoparticles of inoculants in bearing steels and the  $\text{Cr}_7\text{C}_3$  nanoparticles in the inoculant induces the formation of  $\text{M}_7\text{C}_3$  carbides (mainly  $\text{Cr}_7\text{C}_3$ ) in matrix of GCr15. Compared with traditional treat processing, after modification and heat treatment, the microstructure of the GCr15 has been optimized significantly as follows: the grain of the matrix of GCr15 is obviously refined; the number of the carbides particles is increased, and the sizes of all kinds of carbides particle are reduced obviously. The hardness, wear

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