

## Accepted Manuscript

Nd<sub>2</sub>Fe<sub>14</sub>C-based magnet with better permanent magnetic properties prepared by a simple mechanochemical method

Hongmin Geng, Yuan Ji, Jingjing Zhang, Yuchao Gao, Yu Yan, Wenquan Wang, Feng Su, Xiaobo Du

PII: S0304-8853(17)30666-2

DOI: <http://dx.doi.org/10.1016/j.jmmm.2017.05.071>

Reference: MAGMA 62775

To appear in: *Journal of Magnetism and Magnetic Materials*

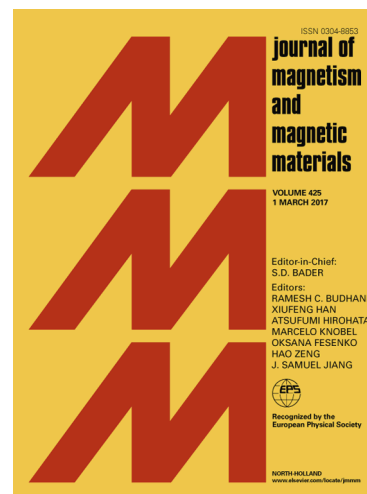
Received Date: 22 February 2017

Revised Date: 19 May 2017

Accepted Date: 24 May 2017

Please cite this article as: H. Geng, Y. Ji, J. Zhang, Y. Gao, Y. Yan, W. Wang, F. Su, X. Du, Nd<sub>2</sub>Fe<sub>14</sub>C-based magnet with better permanent magnetic properties prepared by a simple mechanochemical method, *Journal of Magnetism and Magnetic Materials* (2017), doi: <http://dx.doi.org/10.1016/j.jmmm.2017.05.071>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



1 Nd<sub>2</sub>Fe<sub>14</sub>C-based magnet with better permanent magnetic properties

## 2 prepared by a simple mechanochemical method

3 Hongmin Geng, Yuan Ji, Jingjing Zhang, Yuchao Gao, Yu Yan, Wenquan Wang, Feng Su, Xiaobo

4 Du<sup>1</sup>5 *Key Laboratory of Physics and Technology for Advanced Batteries (Ministry of Education),*6 *College of Physics, Jilin University, Changchun 130012, PR China*7 **Abstract**

8 Nd<sub>2</sub>Fe<sub>14</sub>C-based magnet is prepared by a mechanochemical method, namely high-energy  
9 ball-milling Nd<sub>2</sub>Fe<sub>11</sub>B<sub>x</sub> (x=0-0.15) alloy in heptane (C<sub>7</sub>H<sub>16</sub>), followed by annealing to 850°C in  
10 vacuum. Under the action of high-energy ball-milling, Nd<sub>2</sub>Fe<sub>11</sub>B<sub>x</sub> react with heptane to form  
11 NdH<sub>2+δ</sub>, Fe-(CB), C, etc. H<sub>2</sub> is released and Nd<sub>2</sub>Fe<sub>17</sub>, Nd<sub>2</sub>Fe<sub>17</sub>C<sub>x</sub> (x=0-3), Nd<sub>2</sub>Fe<sub>14</sub>C, Nd carbides  
12 and α-Fe are formed in the subsequent annealing. C amount depends on ball-milling time *t*. Long  
13 time ball milling or high C content suppresses the formation of 2:17 phase and favors the  
14 formation of 2:14:1 phase in the final products. Excessive ball-milling results in the quick increase  
15 of α-Fe. The maximum of magnetically hard Nd<sub>2</sub>Fe<sub>14</sub>C is obtained at *t* = 4 h. For Nd<sub>2</sub>Fe<sub>11</sub> samples,  
16 there exists considerable quantity of Nd carbides and α-Fe phase appears earlier and increases  
17 rapidly with extending the ball-milling time *t*. The addition of B element shortens the ball-milling  
18 time of the formation of maximum Nd<sub>2</sub>Fe<sub>14</sub>C and prominently suppresses the formation of Nd  
19 carbide and α-Fe. The optimum magnetic properties, coercivity *i*H<sub>c</sub> of 1193.7 kA/m, remanence *M*<sub>r</sub>  
20 of 580.9 kA/m, maximum magnetic energy product (*BH*)<sub>max</sub> of 91.7 KJ/m<sup>3</sup> is approaching to its  
21 theoretic value of 99.2 KJ/m<sup>3</sup> for isotropic Nd<sub>2</sub>Fe<sub>14</sub>C magnet, are obtained in Nd<sub>2</sub>Fe<sub>11</sub>B<sub>0.06</sub> alloy  
22 ball milled for 3.5h.

23 Keywords: Nd<sub>2</sub>Fe<sub>14</sub>C; mechanochemical method; high-energy ball-milling; magnetic properties;  
24 heptane

25 **1. Introduction**

26 Similar to the tetragonal Nd<sub>2</sub>Fe<sub>14</sub>B (2:14:1) compound which is applied widely as permanent  
27 magnet [1-3], the Nd<sub>2</sub>Fe<sub>14</sub>C compound also exhibits excellent intrinsic permanent magnetic  
28 properties [4-5]. The magnetization of Nd<sub>2</sub>Fe<sub>14</sub>C compound is a little smaller than that of

---

<sup>1</sup> Corresponding author: duxb@jlu.edu.cn

Download English Version:

<https://daneshyari.com/en/article/5490441>

Download Persian Version:

<https://daneshyari.com/article/5490441>

[Daneshyari.com](https://daneshyari.com)