Abstract Submitted
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Dy-Free Nd-Fe-B Based Permanent Magnets ARJUN PATHAK, MAHMUD KHAN, KARL GSCHNEIDNER, JR., RALPH MCCALLUM, VITALIJ PECHARSKY, The Ames Laboratory, US DOE, Iowa State University, Ames, Iowa 50011-3020, USA — $Nd_2Fe_{14}B$ based permanent magnets are the current state of the art for high performance magnets. The prototype crystallize in the $P4_2$ / *mnm* tetragonal crystal structure, where the Nd atoms occupy the *4f* and *4g* sites, Fe atoms occupy six different atomic sites (*16k*$_1$, *16k*$_2$, *8j*$_1$, *8j*$_2$, *4e*, *4c*), and B occupies only the *4g* site. The leading contribution to the magnetocrystalline anisotropy in $Nd_2Fe_{14}B$ energy comes from the Nd ions, which strongly prefer a *c*-axis alignment at ambient temperature. $Nd_2Fe_{14}B$ permanent magnet has excellent magnetic properties at room temperature but has poor high temperature properties (T>400 K). A small amount of Dy (up to 10%) is substituted for Nd in $Nd_2Fe_{14}B$ to increase the high temperature performance. Although Dy containing $Nd_2Fe_{14}B$ magnets are desired for high temperature applications, the high price and limited supply of Dy urges the development of Dy-free permanent magnets. Here, we discuss the magnetic properties of several Dy-free Nd-Fe-B based nanostructured magnets and propose alternatives for Dy-based $Nd_2Fe_{14}B$ permanent magnets for high temperature applications such as electric drive motors and wind turbines. This work was supported by the U.S.DOE, ARPA-E, Rare Earth Alternatives in Critical Technologies for Energy (REACT). The research was performed at the Ames Laboratory which is operated for the U.S. DOE by Iowa State University under contract #DE-AC02-07CH11358.

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