U.S. Department of Energy
Categorical Exclusion Determination Form

Program or Field Office: Advanced Research Projects Agency - Energy (ARPA-E)

Project Title: 25A4800 -High Energy Permanent Magnets for Hybrid Vehicles and Alternative Energy

Location: Delaware

Proposed Action or Project Description: American Recovery and Reinvestment Act: ☒

The purpose of this proposal is to exploit recent advances in materials preparation and characterization techniques, guided by state-of-the-art theoretical and computation methods to develop the next generation permanent magnets with magnetic energy density (maximum energy product) greater than 100 MGOe, a nearly twofold increase over that of the strongest Nd-Fe-B magnets. To achieve this we must develop permanent magnets with remanent magnetization of at least 20 kG. No known magnetic material possesses such high magnetization together with a high uniaxial anisotropy. We will undertake an intense concerted effort to develop such a material using three different routes. The first route will be aimed at discovering new materials with high anisotropy and high saturation magnetization in ternary rare earth (RE) - transition metal (TM) - element X systems, which have not yet been explored due to synthesis difficulties such as high vapor pressure, high reactivity, toxicity or their refractory nature. The RE-TM-X systems with X = Li, Mg, P, S, As, Se, Sb, Te, F, Cl, Br, or Zn still offer a large unexplored space for the search and discovery of new hard magnetic materials. The second route will be aimed at the development of RE-free uniaxially anisotropic materials. Efforts will be focused on Fe-, Co- or Mn-rich materials doped with 4d- and 5f-TM atoms. Addition of small nonmagnetic atoms such as B and C will be used to stabilize the desired structures, tune the exchange bonds and adjust their anisotropy. The third route will be aimed at the development

Categorical Exclusion(s) Applied:

X - B3.6 Siting/construction/operation/decommissioning of facilities for bench-scale research, conventional laboratory operations, small-scale research and development and pilot projects

*-For the complete DOE National Environmental Policy Act regulations regarding categorical exclusions, see Subpart D of 10 CFR10 21 Click Here

This action would not: threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive Orders; require siting, construction, or major expansion of waste storage, disposal, recovery, or treatment facilities, but may include such categorically excluded facilities; disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; or adversely affect environmentally sensitive resources (including but not limited to those listed in paragraph B.(4)) of Appendix B to Subpart D of 10 CFR 1021). Furthermore, there are no extraordinary circumstances related to this action that may affect the significance of the environmental effects of the action; this action is not "connected" to other actions with potentially significant impacts, is not related to other proposed actions with cumulatively significant impacts, and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211.

Based on my review of information conveyed to me and in my possession (or attached) concerning the proposed action, as NEPA Compliance Officer (as authorized under DOE Order 451.1B), I have determined that the proposed action fits within the specified class(es) of action, the other regulatory requirements set forth above are met, and the proposed action is hereby categorically excluded from further NEPA review.

NEPA Compliance Officer: /s/ William J. Bierbower

Digitally signed by William J. Bierbower
DN: cn=William J. Bierbower, o, ou, email=william.bierbower@hq.doe.gov, c=US
Date: 2010.01.15 12:48:54 -05'00'

Date Determined: 01/15/2010

Comments:

Webmaster:

be used to stabilize the desired structures, tune the exchange bonds and adjust their anisotropy. The third route will be aimed at the development of high-energy exchange-coupled anisotropic nanocomposite materials utilizing the high uniaxial anisotropy of existing ($SmCo_5$, $Nd_2Fe_{14}B$, $Sm_2Fe_{17}N_x$) or the newly discovered hard magnetic materials and the high saturation magnetization of the Fe-Co alloys. The nanocomposites will be fabricated by the bottom-up approach, by assembling together either separately synthesized magnetically hard and magnetically soft nanoparticles or coreshell hard-soft particles. A variety of fabrication techniques including chemical synthesis, surfactant-assisted ball milling, decrepitation of nanocrystalline precursors and nanoparticle coatings will be employed for the preparation of the elemental building blocks of the nanocomposites. A multidisciplinary team of magnet experts consisting of chemists, material scientists, physicists and engineers from academia (University of Delaware, University of Nebraska, Northeastern University, Virginia Commonwealth University), national labs (Ames Laboratory) and industry (Electron Energy Corporation) is assembled to undertake a concerted, systematic and innovative study to overcome the problems involved and develop the next generation high energy permanent magnets. The proposed research and development will be directed by George Hadjipanayis who is an expert in the science and technology of permanent magnets and has managed successfully large interdisciplinary programs in the past. These magnets are indispensable for many applications in electric, electronic and automobile industries, communications, information technologies and automatic control engineering and directly affect their energy efficiency. Currently the demand for these magnets is even higher with the emerging markets of hybrid/electric vehicles, wind mill power systems, more economical and environmentally friendly transportation systems, power generation systems and energy storage systems. The proposed research and development will provide the fundamental innovations and breakthroughs which could have a major impact in re-establishing the US as a leader in the science, technology and commercialization of this very important class of materials and help decrease our dependence on China. Furthermore, this high-risk project, if successful, will lead to lower cost more efficient energy and power dense devices that will result in a substantial reduction in the nation's dependence upon foreign sources of fossil fuels.