High Performance Permanent Magnets sustainable for Next Generation

Summary

The consortium is proposed to address the issues of scarce availability and high-cost materials in Permanent Magnets (PM) and to offer alternative solutions for these issues.
The current high performance PM heavily depend on Rare-Earth elements (RE). More than 95% of current production capacity for RE required for PM is in China. Availability of Chinese RE to other nations depends on continued stability in China's internal politics and economy, and its relation to other countries. Also, RE extraction processes lead to serious environmental problems. Those issues create risks for global markets and cause geopolitical dynamics with potential to affect the strategic interests of numerous nations.
The consortium aims to develop RE-free PM. The materials of choice are Mn-bsed alloy systems such as Mn-Al, Mn-Bi and Mn-Al-Bi. The goal is to achieve an energy product (= the energy to be stored in the PM) comparable to that NdFeB PM. Emphasis focuses on thin films and nano-particles of PM with (BH)max of about 25 MGOe as the first step. Such PM have the potential to make possible new applications such as magnetic MEMS and biomedical sensors.
The second step will focus on the development of PM with beyond 25MGOe. The advantages of using Mn alloys are that their magnetic properties exhibit high magnetic anisotrophy and high coercivity, key for strong PM, and that these elements are abundant in the earth, thus providing the opportunity to establish a cost-effective and sustainable manufacturing process.
The consortium consists of six organizations from three countries. All the partner members have had rich experience on PM including the proposed Mn alloy systems. The consortium will work on RE free PM from fundamental materials issues, processing and manufacturing, and cost-effectiveness points of view. Also, emphasis will be placed on training students and post-doctoral fellows.
The management of the consortium will be handled by the Center for Materials for Information Technology at the University of Alabama, USA.