"Synthesis of Intermetallic Compounds as Permanent Magnets"

VCU # 12-057

Applications

- Electric Vehicles
- Alternative energy products
- Generators and motors
- Energy Storage
- Consumer electronics and appliances
- Medical technologies
- Military applications

Advantages

- Uses non rare-earth metals
- Simple continuous flow synthesis process
- Competitive with rare earth magnetic products
- Precise control on the material properties
- Easy and cost effective to scale up to commercial production

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Market Need

Permanent magnets are an indispensable component in many applications such as hybrid electric vehicles, wind power, magnetic refrigeration, and flywheel energy storage. Rare earth elements are often used in the production of these magnets. However, given the current market, finding an alternative to the rare earth elements would be beneficial.

Existing wet chemical synthesis process for magnetic material is almost exclusively carried out using batch processing, which is less efficient for large scale production.

Technology Summary

Researchers at Virginia Commonwealth University have created a material using a novel method of synthesis of magnetic nanoparticles without the use of rare earth metals. The inventors have successfully created cobalt carbide nanoparticles with a 3.4 kOe coercivity at room temperature and a magnetic energy density better than 20 kJm^{-3} by using a polyol reduction chemistry. By altering the size and composition of the nanoparticle, the coercivity, energy product, and magnetocrystalline anisotropy can be manipulated. They are now working on creating new intermetallic compounds that could have even better magnetic properties. The synthesis is easy to scale up to commercial production levels; this scale up does not come with a large cost increase.

Technology Status

Patent pending: U.S. and foreign rights are available.

Harris, V. G., et al. "High Coercivity Cobalt Carbide Nanoparticles Processed via Polyol Reaction: A New Permanent Magnet Material." *Journal of Physics D: Applied Physics* 43.16 (2010): 165003.

This technology is available for licensing to industry for further development and commercialization.