**Presentation title: Rare-earth free permanent magnet –transition 3d metal and Si doped iron phosphide (Fe2P)**

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Since neodymium–iron–boron (Nd2Fe14B) permanent magnet was developed in 1985 (J. Appl. Phys. 57, 4094 (1985)), a permanent magnet with higher performance has not been reported yet. Ever since, search for permanent magnet materials that do not contain rare-earth elements, but compatible to ferrites in price, is underway. The iron phosphide (Fe2P) compound forming in the hexagonal structure has attracted much experimental as well as theoretical attention due to its peculiar magnetic properties. From a technological point of the Fe2P compound is interesting due to its large uniaxial magnetocrystalline anisotropy, thus being a candidate for a good permanent magnet. It has not been found in the application due to its low Curie temperature. A main goal is applied research has been to try to increase the Curie temperature by certain alloying substitutions without decreasing the anisotropy energy. In this presentation, we will review the properties that make a material good permanent magnet, including saturation magnetization, uniaxial magnetocrystalline anisotropy, maximum energy density product, Curie temperature, and thermodynamic stability and discuss our approach to designing new permanent magnet rare-earth free elements while retaining a comparable performance with Nd2Fe14B. In addition, preliminary results of our density-functional theory calculations, implemented in VASP, through the collaborations with our collaborators at the Incheon National University, South Korea, and Oak Ridge National Laboratory, USA, for the selected Fe−P−Mn, Fe−P−Si, and Fe−P−Mn-Si alloys, will be presented.

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**Biography**

Otgonzul Narantogtokh is a dedicated and ambitious master's student pursuing advanced studies in Physics at National University of Mongolia. With a passion for unraveling the mysteries of the universe through scientific inquiry, She has embarked on a journey to expand the boundaries of human knowledge in the realm of theoretical and experimental physics. Born with an insatiable curiosity and a keen intellect, Otgonzul Narantogtokh demonstrated an early aptitude for mathematics and science. She pursued her undergraduate degree in Physics with distinction, earning accolades for her academic achievements and contributions to research endeavors. During her undergraduate years, Otgonzul Narantogtokh delved into various branches of physics, ranging from classical mechanics to quantum field theory. She exhibited exceptional analytical skills and a penchant for tackling complex problems, earning her the admiration of her peers and mentors alike. Motivated by a desire to deepen her understanding of the fundamental forces governing the universe, Otgonzul Narantogtokh embarked on her master's journey with a focus on condensed matter physics. Under the guidance of her esteemed advisors, she has been engaged in cutting-edge research aimed at addressing some of the most pressing questions in modern physics. Outside of her academic pursuits, Otgonzul Narantogtokh is deeply committed to fostering collaboration and knowledge exchange within the scientific community. She actively participates in outreach initiatives aimed at promoting STEM education and inspiring the next generation of scientists. Otgonzul Narantogtokh is honored to have the opportunity to present her latest research at the esteemed Materials Science and Engineering. She is eager to engage with fellow researchers, exchange ideas, and contribute to the collective advancement of scientific understanding.