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Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 21 May 2024, 9:00 s.t., UDE, in Person and via Zoom

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Structural stability and non-ergodic behaviour of impurity doped martensites

Abstract:

Non-ergodicity, shell ferromagnetism, etc., are caused due to impurity doping in martensitic alloys. Dopants form nanoscopic point defects within the host matrix and introduce new interactions, often breaking the ergodic behaviour. An increase in the concentration of the dopants, or temper annealing, facilitates the segregation of these point defects and leads to a phase separation. However, the segregation process of these defect phases is not clearly understood. We attempt to understand these behaviours by studying the local structures of the host atoms and impurities doped in some martensitic alloys using X-ray absorption fine structure (XAFS) spectroscopy. In Ni50+xTi50-x alloys, we show that the ergodicity is interrupted by the formation of bcc Ni defects within the martensitic B19' NiTi. With the increase in Ni concentration, the defect phase segregates and phase separates as fcc Ni. A similar observation is noted in the martensitic Ni0.50Mn0.375In0.125 doped with Fe at the Mn site. Here, the long-range order of the elastic strain vector is obstructed by the formation of the γ-FeNi phase.

On the other hand, in indium-doped NiMn, the In atoms are accommodated within the lattice by a structural ordering and a conversion from B2 to L2¬1 structure. Using XAFS, we demonstrate that point defects are segregated even in such structurally single-phase alloys, in which phases separate upon temper annealing. Further extension of this work to other Mn-rich Heuslers will also be discussed.

About the speaker:

Kaustubh Priolkar is Professor of Physics at Goa University. His research activities are concentrated around studying different functional materials using x-ray absorption fine structure (XAFS) spectroscopy. Priolkar is also involved in developing low-cost experiments for improving Physics education.

Kaustubh Priolkar obtained his PhD in 1999 for his work on inelastic neutron scattering studies of cerium-based Kondo systems. Such experiments were performed for the first time in India at Bhabha Atomic Research Centre, Trombay.

Prof. Priolkar has been elected as a member of National Academy of Sciences of India, Allahabad. He is a recipient of the Material Research Society of India's medal lecture award in 2015. He was visiting professor at the Chimie Paris-Tech, Paris, France and has successfully executed a joint Indo-French project. Presently he serves as a member of the National Steering committee of DST (India) – DESY (Germany) Project. He is also a member of the User's committee of the UGC-DAE Consortium for Scientific Research, Mumbai Centre.