Local Structure Defects and the Non-ergodic Ground States in Martensites and Antiperovskites

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Point defects above a critical concentration are responsible for the suppression of long-range order and conversion to a non-ergodic state like a glassy state. This is true for a crystal converting to structural glass, ferromagnet to spin glass, ferroelectric to a relaxer or martensite to strain glass. Though there are several studies on glass transitions, very few studies focus on identifying the defect phase and understanding the structural distortions caused by the doped impurities. Using Extended X-ray Absorption Fine Structure (EXAFS) and other structural probes we elucidate the structure of the defect phases and the structural distortions responsible for glassy ground states in martensitic alloys and antiferromagnetic cubic antiperovskites.

In Ni-rich NiTi, the strain glass phase is caused due to the formation of body-centred cubic Ni defect phase embedded among the B19' martensitic NiTi grains[1]. A similar defect phase, γ-FeNi, is responsible for strain glass state in $Ni_2Mn_{1.5-x}Fe_xIn_{0.5}$[2]. In Mn_3SnC antiperovskite, the antiferromagnetic order is shown to be stabilized due to local structural distortions in the Mn sub-lattice[3]. The nature of these distortions depends on the strain imparted by Mn_6C octahedral by the A site atom which leads to local phase separation and a cluster glassy ground state[4,5]. We also discuss the scenarios of non-formation of non-ergodic states in Heusler martensites[2,6].

References

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