Carnegie Mellon

Materials Science and Engineering Seminar Series

Materials Research at Carnegie Mellon

Sai Prasanth Venkateswaran

Graduate Research Assistant
Department of Materials Science and Engineering
Carnegie Mellon University

"Characterization of magnetic and martensitic domain structures and their interactions in Heusler based ferromagnetic shape memory alloys using transmission electron microscopy"

Friday, September 23, 2005
11:00 AM, Hamerschlag Hall B131
Refreshments at 10:30 AM in Wean Hall 2327 (Mehl Room)

Several material systems undergo multiple solid-solid phase transformations. Studying the characteristic features associated with the different transformations forms an important part of phase transformation studies. As such, the phase transformations in these systems are characterized by multiple order parameters. These systems become a lot more interesting when there is a coupling between the different order parameters. This means that the characteristic features of one transformation interact with, and influence the characteristic features of the other. In many situations, direct observation of these interactions is essential in order to completely understand these features, as indirect observation tools such as magnetization, specific heat and other property measurements lack in their ability to completely characterize them. Some of the direct observation techniques that serve the above purpose include microscopy methods (optical, transmission, magnetic) and diffraction methods (x-ray, neutron). The use of a specific technique depends on the kind and length scale of these interactions.

Our study focuses on material systems which exhibit a magnetic and a martensitic transformation. *Ferromagnetic shape memory alloys (FSMAs)* fall under this category. The transformations in FSMAs are accompanied by the formation of domains and domain boundaries (both magnetic and martensitic). These materials display a significant amount of magnetoelastic interaction due to a coupling between the magnetic and structural degrees of freedom. These interactions usually occur at length scales ranging from several microns to a few nanometers. Direct observation of the interactions and the domain structures at these length scales is achieved in transmission electron microscopy (TEM) studies. TEM offers the possibility of imaging both the martensitic domains (conventional TEM) and magnetic domains (Lorentz TEM) at the same time. Using the aforementioned imaging modes of TEM, we will be studying the domain structures and their interactions in these systems.

Sai Prasanth Venkateswaran finished his undergraduate studies (B.Tech in Metallurgical Engineering) in Indian Institute of Technology, Madras in 2001. His undergraduate work was primarily in the study of magnetic properties of erbium and terbium doped colossal magneto resistive manganites. He joined Carnegie Mellon University (CMU) in the year 2001. He obtained his Masters in the year 2002. He is currently working towards his doctoral thesis under the guidance of Professor Marc De Graef. His work focuses on study of interrelationships between the magnetic and structural features in ferromagnetic shape memory alloys.