# Carnegie Mellon
## Materials Science and Engineering Seminar Series
*Materials Research at Carnegie Mellon*


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# "Crystallization and Magnetic Field Processing of Co-Rich Fe,Co-Based Amorphous and Nanocrystalline Alloys"

**Friday, April 4, 2008**
**11:30 A.M. Seminar in Baker Hall A51**
*Refreshments precede seminar at 10:30 A.M. in 2325 Wean Hall*

Nanocrystalline/amorphous composites are "state-of-the-art" soft magnetic materials obtained by crystallizing melt-spun amorphous ribbons to form nanocrystalline transition-metal rich phase embedded within an intergranular amorphous matrix. Fe-based nanocomposites including the well known Finemet (Fe-Nb-Si-B), NanoPerm (Fe-Zr-B), and HiTPerm (Fe-Co-Zr-B) alloys have been studied most intensely because of large saturation inductions. However, Co-based alloys have been observed to exhibit a particularly strong response to magnetic field processing techniques which is of great technological interest.

The crystallization and response to magnetic field processing of Co-rich Co-Fe-Zr-B alloys will be discussed. For these alloys, the phase evolution is more complex than for the Fe-rich alloys. Interesting observations that will be discussed include:

1) Preferential nucleation of $\alpha$(bcc)-phase for compositions where $\gamma$(fcc) is predicted based on the phase diagram.
2) The observation of a four-phase mixture of nanocrystalline $\alpha$(bcc), $\gamma$(fcc) and $\varepsilon$(hcp) phases embedded in an amorphous matrix for dilute Fe-containing alloys.
3) A strong response to magnetic field processing for dilute Fe-containing alloys.

The results will be discussed in terms of experimental data obtained using XRD, conventional and high resolution TEM, AC permeametry, and 3DAP. A brief discussion of some of the experimental results in terms of a classical nucleation model will also be presented.

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Paul received a dual Bachelor degree in Economics and Engineering Physics from the University of Pittsburgh in 2005 and a Master degree in Materials Science and Engineering from Carnegie Mellon University in 2006. He is currently a Ph.D. candidate under the guidance of Prof. McHenry and Prof. Laughlin.