CBNU
CHUNGBUK NATIONAL UNIVERSITY

BK21
The Physics Based Human Resources Development Program for the Next Generation Devices

# Local Structure and Magnetic Properties of FeMnAl Metastable Alloys

K. Tarigan[1], D. S. Yang[2], T. L. Phan[1], S. K. Oh[1] and S. C. Yu[1*]

[1]BK 21 Program, Department of Physics, Chungbuk National University, Cheongju 361-763, South Korea
[2]Physics Division, School of Science Education, Chungbuk National University, Cheongju, 361-763, South Korea

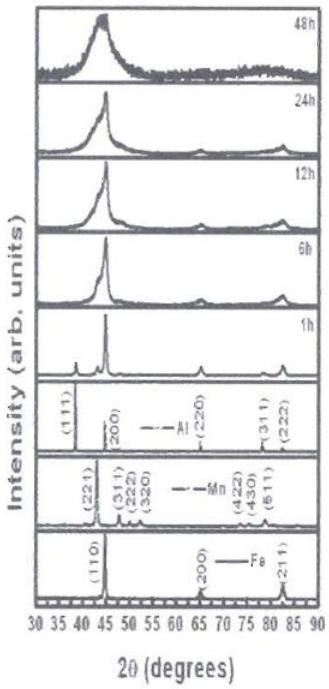
## Introduction

- The study of melted Fe-Mn-Al disorder system is important due to the presence of competitive and diluted exchange interactions, which allow to obtain different magnetic phase as paramagnetic, ferromagnetic, spin-glass, reentrant spin-glass an antiferromagnetic phases.
- Magnetic phase of Fe-Al-Mn system is dependent on structural changes, Mn and Al concentrations. Especially, the microstructural change leads to a critical change of magnetic properties.

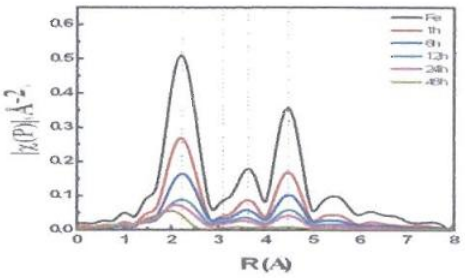
## Experiment

- **Metastable alloys of $Fe_{55}Mn_{10}Al_{35}$ were** studied as functions of the milling time for milling times ranging from 1 hr to 48 hrs.
- **The variations of structure were examined by XRD and EXAFS.**
- **Both the magnetic saturation and coercivity were measured by a VSM magnetometer with a maximum field of 10 kOe.**

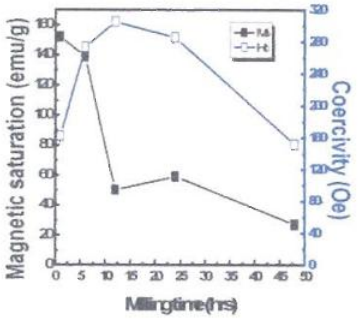
## Results and discussions



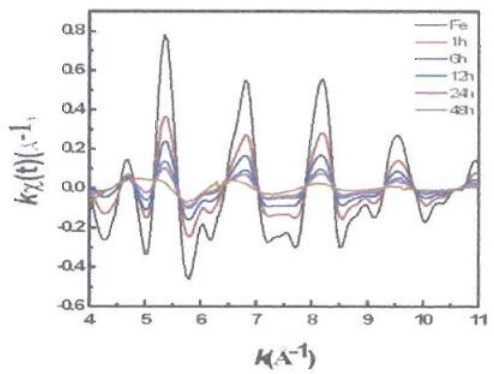

XRD patterns show the samples start active at 6-h milling and more completed afterward. The samples are poly-crystal until 24-h milling, but become amorphous at 48-h, look like single crystal pattern.



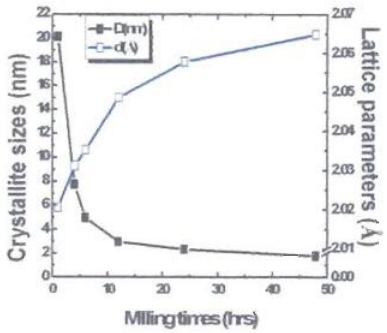

**Fourier transform of the EXAFS spectra weighted with $k^2$ measured at Fe K-edge . Amplitudes are reduced with milling times increased. Start at 12-h milling the peaks are shifted to smaller R and at 48-h he LRO disappeared, the amorphous occurred.**




**The Ms is decreased quickly until 12-h milling , then slowly afterwards . Hc is increased until 12-h milling, then decreased afterwards.**




The normalized Fe-edge EXAFS multiplied by the photoelectron wave number, k with various milling times n addition to amplitude decrease, starting at 12-h k value is also changed.




**Variation of crystallite sizes and lattice parameter calculate using Scherrer's and Bragg's equations on Fe(110).**

## Conclusions

**The alloys with bcc structure started occurring after 2 h milling and more completed afterwards. But, from 48 h the sample has become amorphous. We may control the milling time obtain appropriate $M_s$ and $H_c$ values.**