INVESTIGATION OF NOVEL MAGNETIC MATERIALS BY SCANNING PROBE AND KERR MICROSCOPY

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INSTRUMENTATION

AFM/MFM - atomic force/magnetic force microscopy - scanning probe-like microscopy used for studying the surface properties of various materials up to the atomic dimensions. The mechanical probe that scans the specimen is affected by interacting forces acting between the tip and the surface.

MFM - magnetic force microscopy - imaging probe used for visualization of magnetic contrast from the specimen, is converted into domain image.

MOKM - magneto-optical Kerr microscope - methodology is based on the magneto-optical Kerr effect, where the rotation of plane-polarized light, while reflected from a nontransparent magnetic specimen, is converted in to domain image.

MATERIALS

Fe-Al based alloys
- from pure Fe and Al elements - arc melting in Ar atmosphere
- ingots were cut into round samples (10 mm in diameter, thickness of 50 μm)
- final fabrication of the surface - grinding and polishing
- three different composition:
  - Fe₆₅Al₃₅ (assumed phase - A₂,D₀₃)
  - Fe₆₅Al₃₅ (assumed phase - B₂,D₀₃)
  - Fe₆₅Al₃₅ (assumed phase - B₂,D₀₃)

Fe based bilayered ribbons
- planar flow casting (PFC) method, crucible divided into two chambers
- composition: Fe₉₃Nb₃Si₂B (wheel)/Fe₇₅Si₂B (air)
- thickness of 5 mm and width of 8 mm wide
- surface magnetic properties

SURFACE MAGNETIC PROPERTIES

Fe₆₅Al₃₅

Fe₆₅Al₃₅

Fe₆₅Al₃₅

1) differences between the bulk and surface magnetic properties

2) bulk magnetic properties in agreement with phase diagram
   - Fe₆₅Al₃₅ - ferromagnetic behavior
   - Fe₆₅Al₃₅ - paramagnetic behavior

3) surface magnetic properties (higher Al content) - document magnetic transformation

Explanation: formation of the oxide layer at the surface and/or depletion of the surface layers by aluminium atoms

This work was supported by following grants: IT4Innovations excellence in Science - LQ 1602
Regional Materials Science and Technology Center-Feasibility Program LO1203