Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

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BSc (University of Victoria, 2009)

“Investigation of Calculated Adiabatic Temperature Change of MnFeP1-xAsx Alloys”

Department of Mechanical Engineering

Monday, April 27, 2015
2:30 P.M.
Engineering Office Wing
Room 230

Supervisory Committee:
Dr. Andrew Rowe, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Rustom Bhiladvala, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Subhasis Nandi, Department of Electrical and Computer Engineering, UVic

Chair of Oral Examination:
Dr. Beatriz de Alba-Koch, Department of Hispanic and Italian Studies, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

Magnetic refrigeration is an alternative cooling technology to vapour compression. Due to the large operating space of magnetic refrigeration devices, modelling is critical to predict results, optimize device parameters and regenerator design, and understand the physics of the system. Modeling requires accurate material data including specific heat, magnetization and adiabatic temperature change. For a reversible material adiabatic temperature change can be attained directly from measurement or indirectly through calculation from specific heat and magnetization data. Data sets of nine MnFeP1-xAsx alloys are used to compare calculated against measured adiabatic temperature change. MnFeP1-xAsx is a promising first order material because of a tunable transition temperature, low material cost and large magnetocaloric properties. Because MnFeP1-xAsx alloys exhibit thermal hysteresis there are four possible calculation protocols for adiabatic temperature change; $\Delta T_{ad}$, $HH$, $\Delta T_{ad,CC}$, $\Delta T_{ad,HC}$ and $\Delta T_{ad,CH}$. $\Delta T_{ad,CH}$ deviates the most from measured data and therefore it is assumed that this case is not representative of the material behavior. Results show $\Delta T_{ad}$, $HH$, and $\Delta T_{ad,CC}$ align with measured data as well as $\Delta T_{ad,HC}$. The three protocols that align best with measured data have two consistent errors including a colder peak $\Delta T_{ad}$ and a larger FWHM. With more data sets and analysis a preferred calculation protocol may be found.