Material properties and modeling characteristics for MnFeP$_{1-x}$As$_x$ materials for application in magnetic refrigeration - DTU Orbit (06/03/2019)

Compounds of MnFeP$_{1-x}$As$_x$ have received attention recently for their use in active magnetic regenerators (AMR) because of their relatively high isothermal entropy change and adiabatic temperature change with magnetization. However, the materials also generally exhibit a significant magnetic and thermal hysteresis, and it is not well understood how the hysteresis will affect performance in a practical AMR device. The amount of hysteresis shown by a material can be controlled to an extent by tuning the processing conditions used during material synthesis; therefore, knowledge of the practical impact of hysteresis is a key element to guide successful material development and synthesis. The properties of a magnetocaloric MnFeP$_{1-x}$As$_x$ compound are characterized as a function of temperature and applied magnetic field, and the results are used to assess the effects of hysteresis on magnetocaloric properties. Different methods of building property functions from the measured specific heat, magnetization, and adiabatic temperature change are presented. It is shown that model predictions can be highly dependent on how the properties that are used by the AMR model are calculated. © 2013 AIP Publishing LLC