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Controllable magnetic phase front in a vertically graded Ni_xCu_{1-x} alloy film BRIAN KIRBY, NIST - Natl Inst of Stds & Tech, H.F. BELLIVEAU, D.D. BELYEA, T. EGGERS, University of South Florida, P.A. KIENZLE, A.J. GRUTTER, NIST - Natl Inst of Stds & Tech, P. RIEGO, A. BERGER, CIC nanoGUNE Consolider, C.W. MILLER, Rochester Institute of Technology — We have used polarized neutron reflectometry to study the temperature and magnetic field dependent magnetization depth profile of a ferromagnetic 100 nm Ni_xCu_{1-x} alloy film with x that varies linearly from 0.61 - 0.70 along the growth axis. Modeling the data in terms of a mean-field exchange strength gradient theory, we find that with increasing temperature, the magnetized thickness of the film continuously decreases, indicating a continuous vertical distribution of effective ferromagnetic transition temperatures. For temperatures corresponding to a partially magnetized film, increasing the applied field from 5 mT to 500 mT is observed to significantly alter the shape of the profile, consistent with magnetization of an effectively paramagnetic region. Thus, we demonstrate that this system exhibits a vertical magnetic phase boundary that can be moved continuously along the growth axis with temperature. Such temperature and field control of the magnetized phase boundary could have important implications for our understanding of metamagnetic transitions, as well as for magnetocaloric and thermomagnetic device applications.

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