In-situ growth stresses during the A1 to $L1_0$ chemical ordering reaction

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$L1_0$ FePt is a candidate material for ultrahigh magnetic recording. Considerable interest has developed in the use of ternary additions in FePt that could alter the ordering temperature and control the microstructure. To date, little work has been done to quantify the intrinsic stress evolution that accompanies either the ordering phase transformation or microstructure evolution. The effect of Cu on the *in-situ* growth stresses and chemical ordering reaction in $[Fe_{1-x}(Cu_x)]_{50}Pt_{50}$ thin films with x= 0, 4.5 and 10.5 at. % Cu has been studied. To facilitate order during growth, the substrates temperatures were *in-situ* annealed between 23 °C and 425 °C. During deposition, the stress was quantified using an *in-situ* wafer curvature technique. The films' phase and microstructure were characterized by Transmission Electron Microscopy(TEM) and XRD. As the Cu content increased, a suppression of chemical order during growth was observed, which, in general, is opposite to previous *ex-situ* annealing studies for FePt. During initial annealing, where films undergo compressive-tensile-compressive behavior, there is an increase in the compressive stress. This is not observed in $Fe_{39.5}Cu_{10.5}Pt_{50}$ below 200 °C. This suggests that increase in Cu content alters the adatom mobility. With increasing order parameter, the films exhibited an increase in the rate of post-growth stress relaxation. With increasing *in-situ* deposition temperature, grain growth increases with onset of ordering. The stress evolution is discussed in terms of the degree of order and grain size and their relationship to adatom mobility during the chemical ordering reaction.