GROWTH AND MAGNETOELASTIC BEHAVIOR OF
b-AXIS-ORIENTED DYSPROSIUM

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The rare earth metals have the largest known magnetostrictions, so that their magnetic properties and structural properties are strongly coupled. This coupling is ideally suited for investigation with thin films, in which single crystal films of high quality can be prepared on substrates which cause their lattice parameters to differ from bulk values (strain) and which constrain the strictions which may occur (clamping). The present research describes a new MBE growth procedure to grow single crystal thin films and superlattices of rare earths with the hcp $(1\bar{1}00)$ b-axis normal to the growth plane. To explore the role of strain, clamping and symmetry-breaking in modifying the magnetic ordering temperatures, ultrathin films of strained Dy have been prepared between Y_xLu_{1-x} alloy buffer layers, so that strain can be tuned from compressive (x=0) to tensile (x=1) and chosen values in between. The magnetic ordering temperatures, critical fields, and magnetization behavior vary systematically with strain. This behavior is interpreted in terms of fundamental magnetoelastic interactions and shape anisotropy.

Dedication

To my family. Because of their constant support I always believed I could overcome all obstacles, to become in life whatever I wanted to become.

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