abstract
With the advancements in technology, it is now possible to synthesize new materials with specific microstructures, and enhanced mechanical and physical properties. One of these new classes of materials are nanoscale metallic multilayers, often referred to as nanolaminates. These nanolaminates are composed of alternating, nanometer-thick layers of multiple materials (typically metals or ceramics), and exhibit very high strength, wear resistance and radiation tolerance. This thesis is focused on the fabrication and mechanical characterization of nanolaminates composed of copper and cobalt, two metals which are nearly immiscible across the entire composition range. The synthesis of these Cu-Co nanolaminates is performed using sputtering, a well-known and technologically relevant physical vapor deposition process. Techniques such as X-ray diffraction and transmission electron microscopy are used to characterize the microstructure of the nanolaminates. Cu-Co nanolaminates with different layer thicknesses are tested using microelectromechanical systems (MEMS) based tensile testing devices fabricated using photolithography and etching processes. The stress-strain behaviour of nanolaminates with varying layer thicknesses are analysed and correlated to their microstructure.