CORRELATION BETWEEN STRUCTURAL AND MAGNETIC PROPERTIES IN WEDGED Ti/Co MULTILAYERS

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The Ti/Co multilayers (MLs) with wedge shaped Ti and constant-thickness Co (d_{Co} = 2 nm) sublayers were prepared onto SiO_2/Si(111) substrate using an UHV (5×10^{-10} mbar) DC/RF magnetron sputtering. The magnetic characterisation of the samples was carried out using magnetooptical Kerr effect at room temperature. The structural properties of the wedged MLs were studied by standard UHV scanning tunnelling microscopy (STM). Results showed that the average grain size of the Co sublayer strongly depends on the Ti thickness. The Ti/Co MLs with $d_{Ti} < 0.1$ nm growth in the polycrystalline phase. For $d_{Ti} \approx 0.2$ nm the in-plane grains size rapidly decreases. We have estimated an average grain size of the Co sublayer as small as $D \approx 4$ nm. For thicker Ti sublayer D first increases and then decreases up to $d_{Ti} \approx$ 0.4 nm, reaching a maximum $D \approx 14$ nm for $d_{Ti} \approx$ 0.3nm. It is clear that for $d_{Ti} \approx 0.2$nm and $d_{Ti} > 0.4$nm the Co sublayers are nanocrystalline with the average grain size well below the magnetic exchange length (~10nm). The above behaviour was also confirmed by the coercivity measurements. We have observed the minimal coercivity (~0.2 kA/m) for the minimal grains size of the Co layer. Furthermore, the STM observation with atomic resolution revealed a high grains deformation of the nanocrystalline Co layer, in agreement with recent NMR studies.
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