Magnetic anisotropy manipulation in Ni nanostructures fabricated on VO_2 (100) thin films imaged by time-resolved high resolution x-ray microscopy across the phase transition

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Due to the possibility to generate strain variations on ultra-short timescales, the metal-insulator-transition (MIT) in VO_2 is of particular interest for the study of the dynamics involved in the magnetostrictive coupling. In particular, strain can be manipulated in conventional piezoelectric materials only on slow timescales (<GHz), while here fast strain variations result from the MIT, which occurs on the ps timescale.

In this contribution, we will present x-ray magnetic microscopy imaging of Ni nanostructures fabricated on VO_2 (100) thin films deposited by pulsed-laser-deposition on TiO_2 (100) substrates upon crossing the MIT of the VO_2 (thermally and with fs laser pulses excitation). Due to strain change when crossing the MIT, strong changes in the magnetic anisotropy of the Ni nanostructures were observed, which changed from a low temperature uniaxial-anisotropy dominated state to a high temperature shape-anisotropy dominated state, as shown in Fig1.

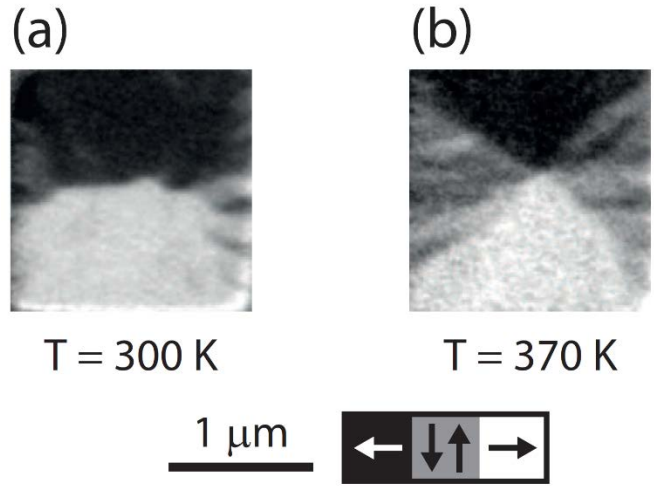

Figure 1: Photoemission electron microscopy images of a nanostructured Ni square showing (a) a pronounced uniaxial anisotropy at 300 K, which changes into a shape-anisotropy dominated state (b) at 370 K.