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Surface distortion of Fe dot-decorated TiO₂ nanotubular templates using ToF-GISAS

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Physical properties of nanoclusters, nanostructures and self-assembled nanodots, which in turn are concomitantly dependent upon the morphological properties, can be modulated for functional purposes. Here, in this article, magnetic nanodots of Fe on semiconductor TiO₂ nanotubes (TNTs) are investigated with time-of-flight grazing incidence small-angle neutron scattering (TOF-GISANS) as a function of wavelength, chosen from a set of three TNT templates with different correlation lengths. The results are found to corroborate with the localized scanning electron microscopy (SEM) images. As we probe the inside and the near-surface region of the Fe-dotted TNTs with respect to their homogeneity, surface distortion, and long-range order using TOF-GISANS, gradual aberrations at the top of the near-surface region are identified. Magnetization measurements as a function of temperature and field do not show a typical ferromagnetic behavior but rather a supermagnetic one that is expected from a non-homogeneous distribution of Fe-dots in the intertubular crevasses.

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