applied sciences

MDPI

Supplemental Material

Strontium Ferromolybdate-Based Magnetic Tunnel Junctions

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1. Characterization of surface morphology by atomic force microscopy

The surface morphology of the Pt bottom electrode and the SFMO films were characterized by means of atomic force microscopy (AFM). SFMO thin films deposited by multi-target reactive sputtering at 600°C were characterized by means of by a Dimension FastScan AFM (Bruker-Nano, Santa Barbara) equipped with silicon nitride sensors ScanAsyst Fluid+ (Bruker) with a nominal spring constant of 0.7 N/m. The topographic images were analyzed using the Gwyddion software, version 2.47 (http://gwyddion.net).

Figure S1 illustrates the determination of the surface roughness of the Pt(111) bottom electrode deposited onto a 150 mm diameter adhesion-layer/SiO_2/Si wafer taking a 5x5 µm² AFM scan.

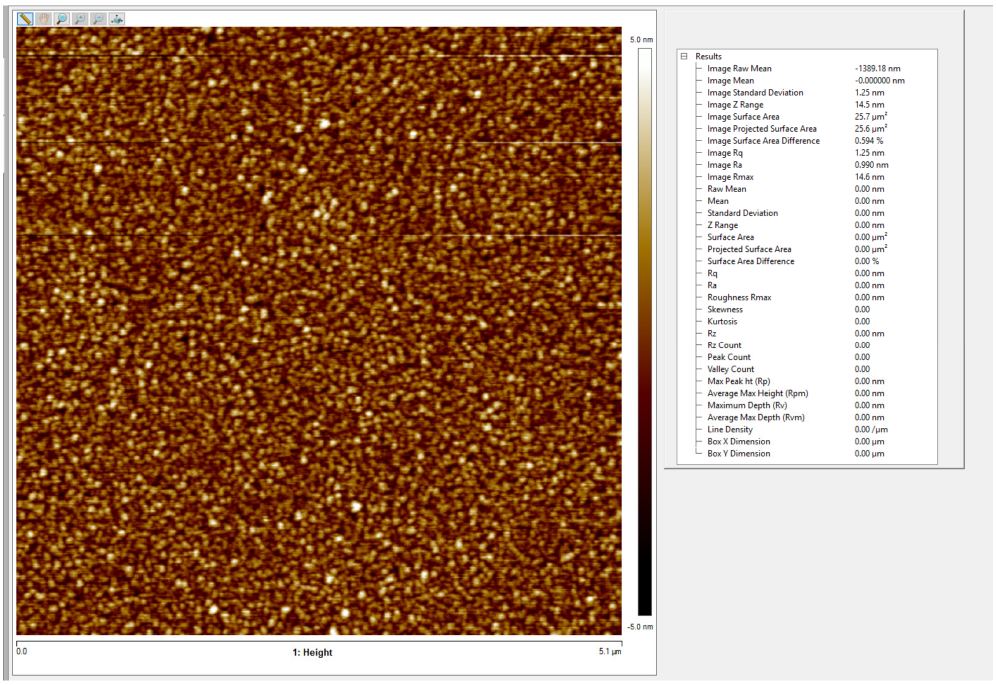

Figure S1. AFM image and determination of the surface roughness of a Pt(111) electrode using the software package Gwyddion.

Figure S2 shows the AFM images of an about 800 nm thick SFMO thin film at three different points of the Si-wafer surface. The one-dimensional power density spectrum of these images was obtained applying Gwyddion.

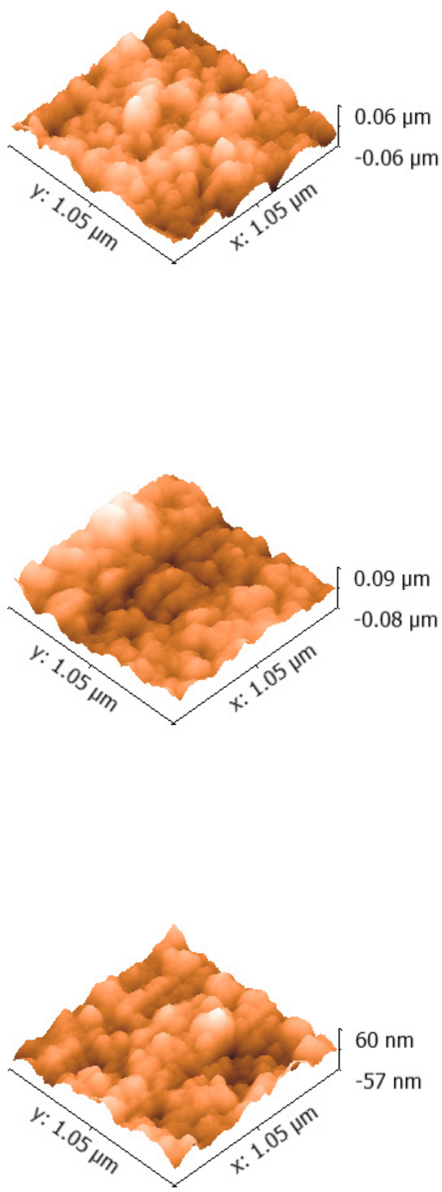

Figure S2. AFM images of SFMO thin films deposited by multi-target reactive sputtering at 600°C taken at three different points with a scan area of 1.05x1.05 μm^2.

SFMO thin films deposited by ceramic target magnetron sputtering and crystallized at 900°C. The final film thickness was about 800 nm. The films were characterized using an MFP-3D Stand Alone AFM system (Asylum Research, Goleta, CA, USA) in the contact mode. The microscope was equipped with a Nanosensors NSHR (Neuchâtel, Switzerland) cantilever with a resonant frequency of 320 kHz and a spring constant k = 42 N/m. The scanned areas were 5x5 μm^2, 10x10 μm^2, 30x30 μm^2 and 70x70 μm^2 with a resolution of 512x512 pixels (at a scanning rate of 0.8 Hz). Also here, the one-dimensional power density spectrum of these images was obtained applying Gwyddion.

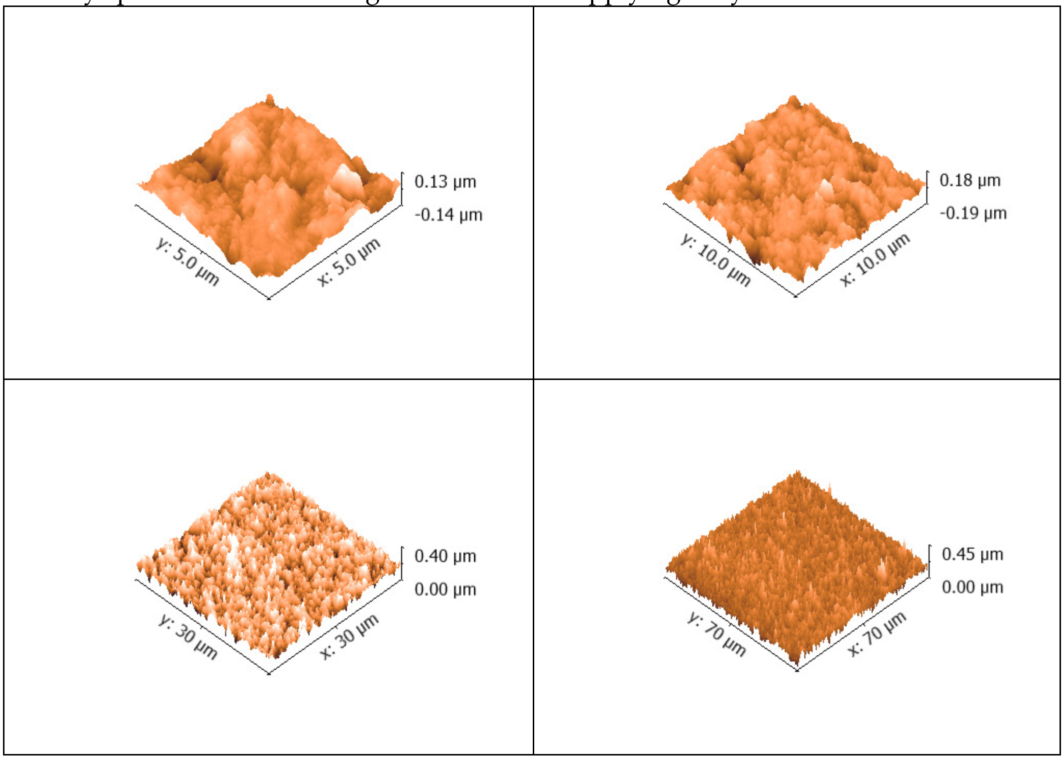

Figure S3. Set of AFM images with different scan size of a SFMO thin film deposited by ceramic target magnetron sputtering and crystallized at 900°C.

2. Determination of the thickness of SFMO layers

In order to evaluate the thickness distribution of SFMO layers on platinized silicon wafers, an accompanying thin film deposition was carried out by multi-target reactive sputtering under oxygen-rich conditions without activating the Fe target. The result is a dielectric, optically nearly transparent $SrMoO_4$ thin film. The local film thickness of this film was measured by means of a white light interferometer (ETA-CSS-BID, ETA-Optik GmbH, Heinsberg, Germany). Figure S3 depicts the thickness distribution on a 150 mm platinized Si-wafer

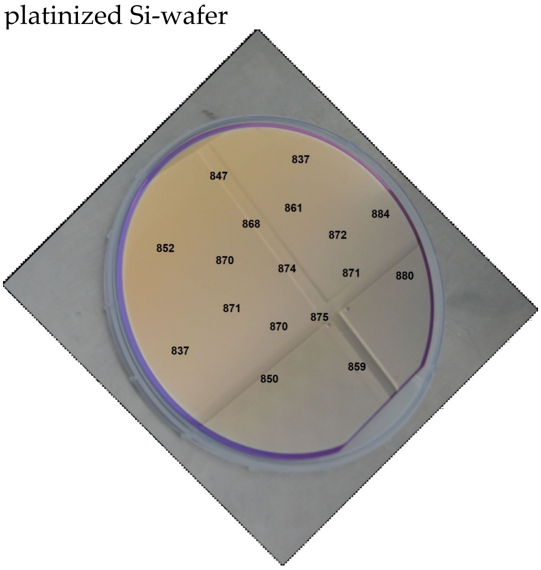

Figure S4. Film thickness distribution of a $SrMoO_4$ thin film deposited onto a 150 mm platinized silicon wafer.