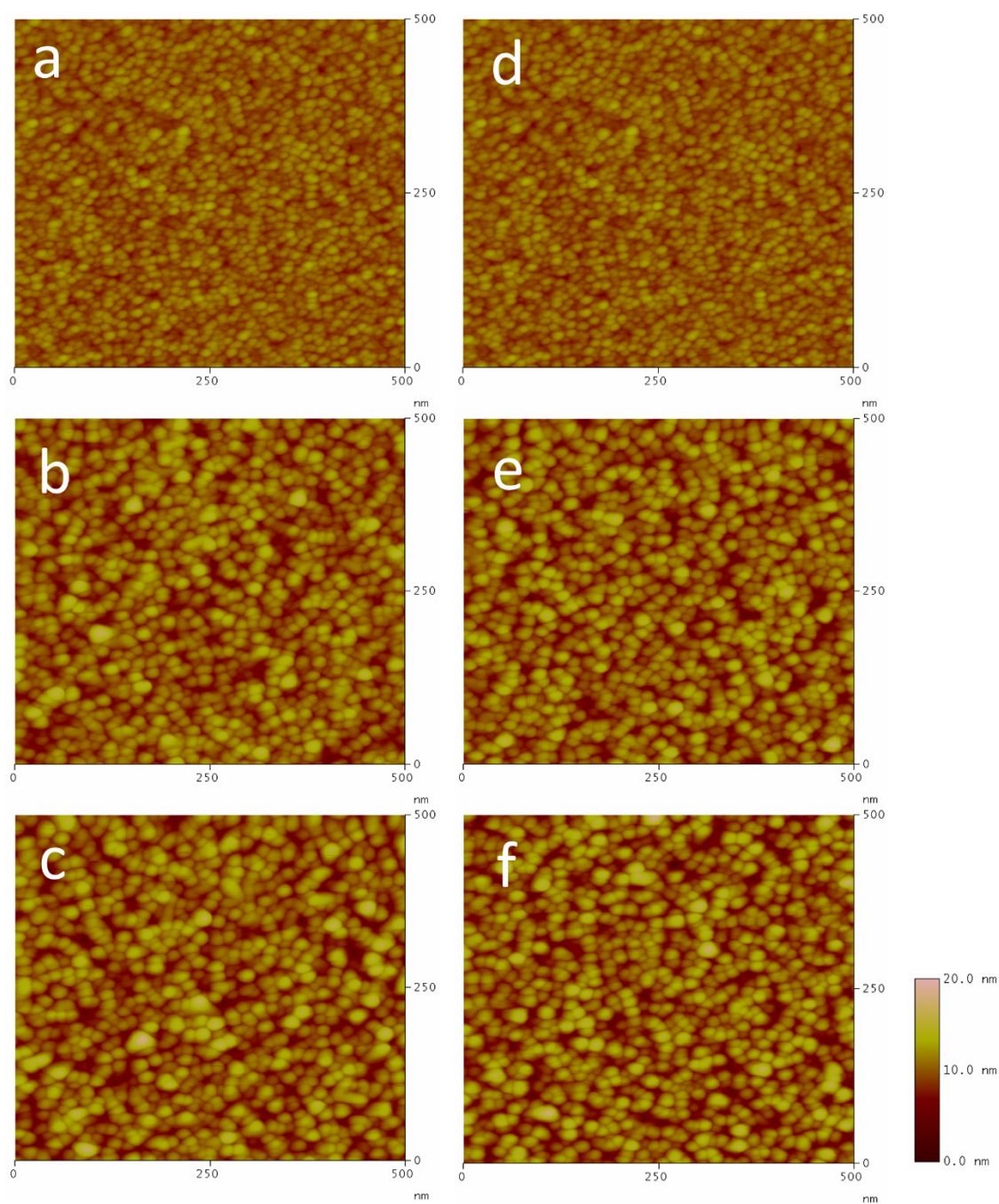
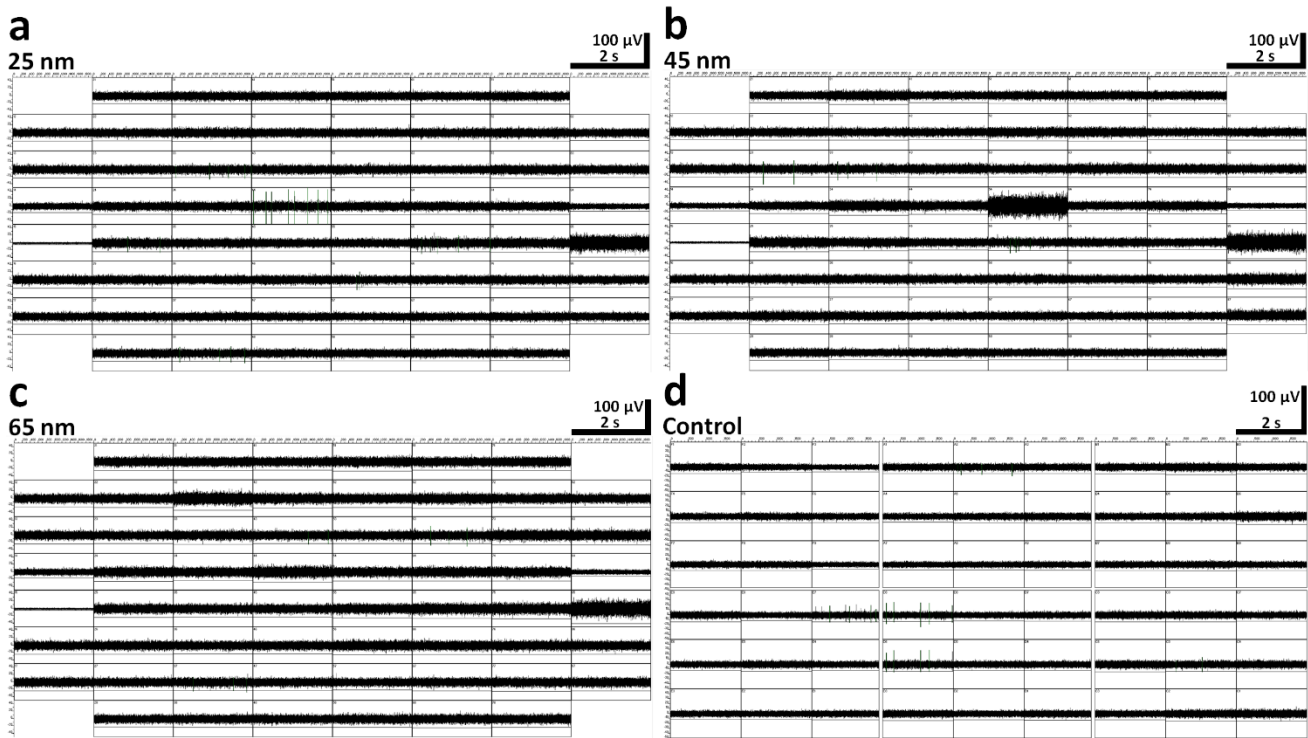


Supplementary Material



Supplementary Figure S1 | AFM images of ALD TiN surfaces on **(a-c)** silicon and **(d-f)** glass substrates. Number of ALD cycles: **(a,d)** 1000, **(b,e)** 2000, and **(c,f)** 3000.



Supplementary Figure S2 | Overview of a typical recording of spontaneous activity on all electrodes of a device. All data was high-pass filtered above 200 Hz. Each small window (2 s, 100 μ V) shows the data on an individual electrode. The grey horizontal line in each window represents the signal detection threshold ($-5 \times$ standard deviation of noise). The overviews are shown for MEAs with **(a)** 25 nm, **(b)** 45 nm and **(c)** 65 nm thick ALD TiN electrodes, as well as a commercial control MEA

(d). The displayed traces were recorded 3 **(b)**, 7 **(a)** and 14 **(c,d)** days after plating on MEA. In **(a-c)** the third and fourth electrodes from the top in the left- and right-most columns did not have corresponding standard electrodes in grid, which causes the aberrant noise levels. In **(b)**, the high noise level in the fourth electrode from the top in the fifth column from the left was caused by a temporary poor connection between the contact pin in the headstage and the contact pad in the MEA. Only a few spikes are visible because the view shows only 2 s of data at a time and because it takes more than 3-14 days for hiPSC-derived neuronal networks to reach maximal activity.