Shape-controlled electrochemical synthesis of mesoporous Si / Fe nanocomposite with tailored ferromagnetic properties

B. BARDET¹, T. DEFFORGE¹, B. NEGULESCU¹, D. VALENTE¹, J. BILLOUE¹, P. POVEDA², G. GAUTIER¹

¹ Université François Rabelais de Tours, CNRS, CEA, INSA-CVL, GREMAN UMR 7347, 16 rue Pierre et Marie Curie, 37071 Tours, France

> ² STMicroelectronics Tours, 16 rue Pierre et Marie Curie 37071 Tours, France E-mail: <u>gael.gautier@univ-tours.fr</u>

SUPPLEMENTARY INFORMATION



Figure S1 - Potential evolution (versus ECS electrode) with time during the electrochemical deposition of iron on a hydrogen-terminated PS surface (black) and on a surface covered by a native oxide (red). The current density was fixed at 2 mA/cm².

The deposition technique was checked on other PS samples with pore diameters in the range 50 nm - 120 nm. To adjust the pore sizes, we modified the current density between 15 mA/cm² and 30 mA/cm² (near J_{PS}) during the anodization step.



Figure S2 - SEM cross-sectional views of PS-Fe nanocomposites with various pore diameters. The anodization current density was changed to 15

 mA/cm^2 (a), 20 mA/cm^2 (c), and 30 mA/cm^2 (b,d) to adjust the pore diameter. The size of FeNPs and FeNWs fits well with the pore diameter.



Figure S3-SEM cross-sectional views of the PS-FeNWs sample using a secondary electrons detector (left) and its corresponding EDX mapping for

the element Fe.



Figure S4 - BSE (left) and SE (right) SEM cross-sectional views of the PS-FeNPs + Parasitic layer sample synthesized on a hydrogen-terminated PS sample.

Table S1 - Magnetic parameters extracted from Out of Pl	ne (OoP) and In Plane (IP)	VSM measurements of PS-FeNPs and PS-FeNWs	composites.
---	----------------------------	---	-------------

Parameters\Sample	PS-FeNPs	PS-FeNWs
OoP Remanence Magnetization M _R	0.25 Ms	0.6 Ms
OoP Coercivity H _C (Oe)	310	470
IP Coercivity H_C // (Oe)	240	240
IP Anisotropy Field H _K (Oe)	~6500	~10000
Surfacic Saturation Magnetization $M_S (10^{-3} \text{ emu/cm}^2)$	6	8
Aspect Ratio of iron	~1	5-20
(from SEM views)	1	5 20