

## Supplementary Information

### Magnetic Characteristics of Copper Ion-Modified DNA Thin Films

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**Figure S1.** The AFM image and  $m$ - $H$  curves of DNA on mica

**Figure S2.** Schematic diagram of DX tiles.

**Figure S3.** Schematic diagram of  $\text{Cu}^{2+}$  adding before and after annealing.

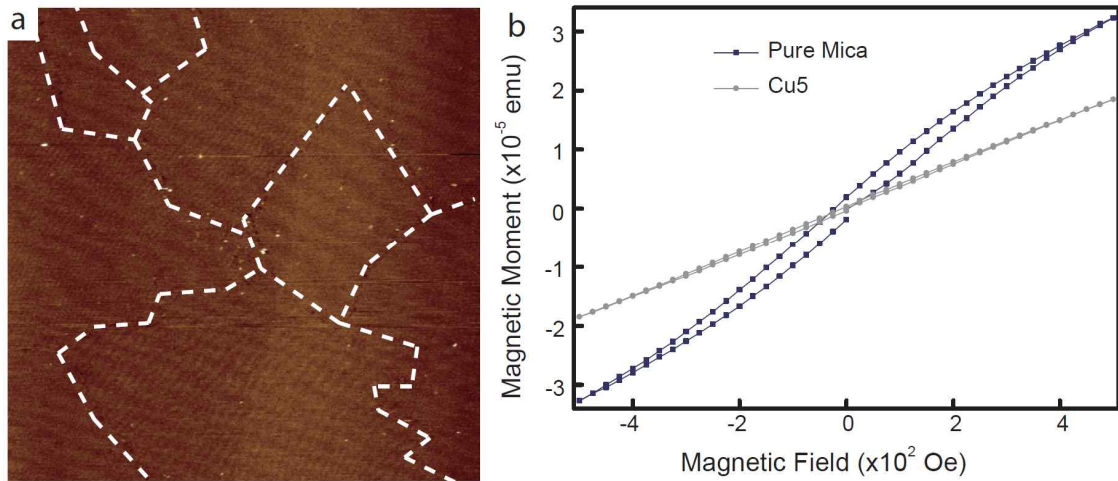
**Figure S4.** AFM images of  $\text{Cu}^{2+}$ -DNA grown on glass

**Figure S5.**  $M$ - $T$  curves of copper on PG.

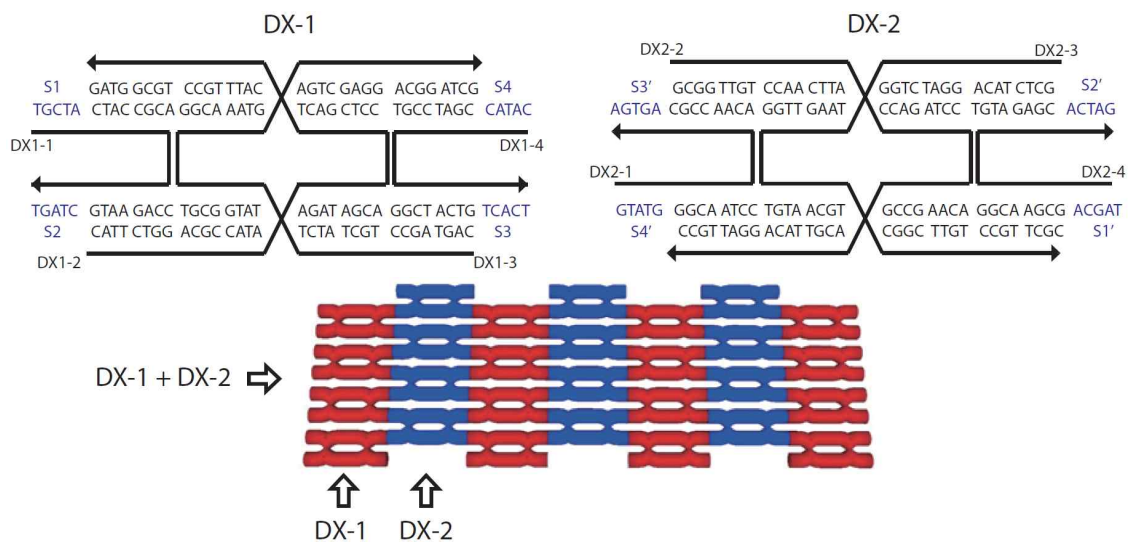
**Table S1.** Sequencing pool for DX tiles.

**Table S2.** Sets of sticky-ends for DX tiles

**Figure S1.** (a) The AFM image (scan size,  $2.5 \mu\text{m} \times 2.5 \mu\text{m}$ ) of DNA on mica. Dotted lines on an image indicate crystal domain boundaries. (b)  $m$ - $H$  curves of pure mica and the DNA thin films with  $5 \text{ mM } [\text{Cu}^{2+}]$  (Cu5) on the mica substrate.



**Figure S2.** A schematic diagram of the double-crossover (DX) [DX = (DX-1) + (DX-2)] tiles. Each tile consisted of four strands DX1-1, DX1-2, DX1-3, and DX1-4 for (DX-1) tile and DX2-1, DX2-2, DX2-3, and DX2-4 for (DX-2). The complementary sticky end pairs are shown as  $S_n$  and  $S_n'$  in sequence drawings (blue).



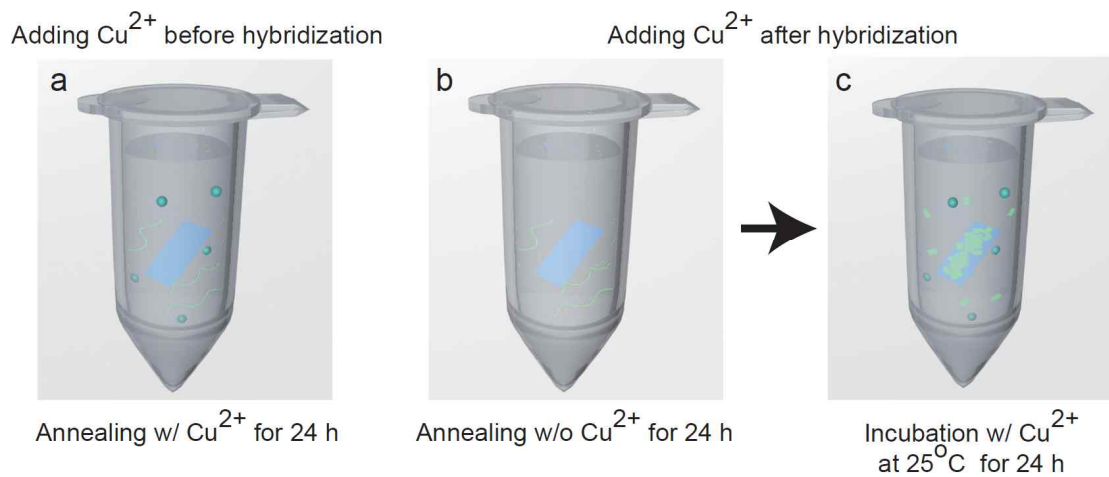
**Table S1.** Sequence pool for the double-crossover (DX) tiles

Strand	Total # of NTs	Sequence (5' to 3')
DX1-1	26	TGCTA CTACCGCA CCAGAATG CTAGT
DX1-2	48	CATTCTGG ACGCCATA AGATAGCA CCTCGACT CATTGCC TGCGGTAG
DX1-3	48	CAGTAGCC TGCTATCT TATGGCGT GGCAAATG AGTCGAGG ACGGATCG
DX1-4	26	CATAC CGATCCGT GGCTACTG TCACT
DX2-1	26	GTATG GGCAATCC ACAACCGC AGTGA
DX2-2	48	GCGGTTGT CCAACTTA CCAGATCC ACAAGCCG ACGTTACA GGATTGCC
DX2-3	48	GCTCTACA GGATCTGG TAAGTTGG TGTAACGT CGGCTTGT CCGTTCCG
DX2-4	26	TAGCA GCGAACGG TGTAGAGC ACTAG

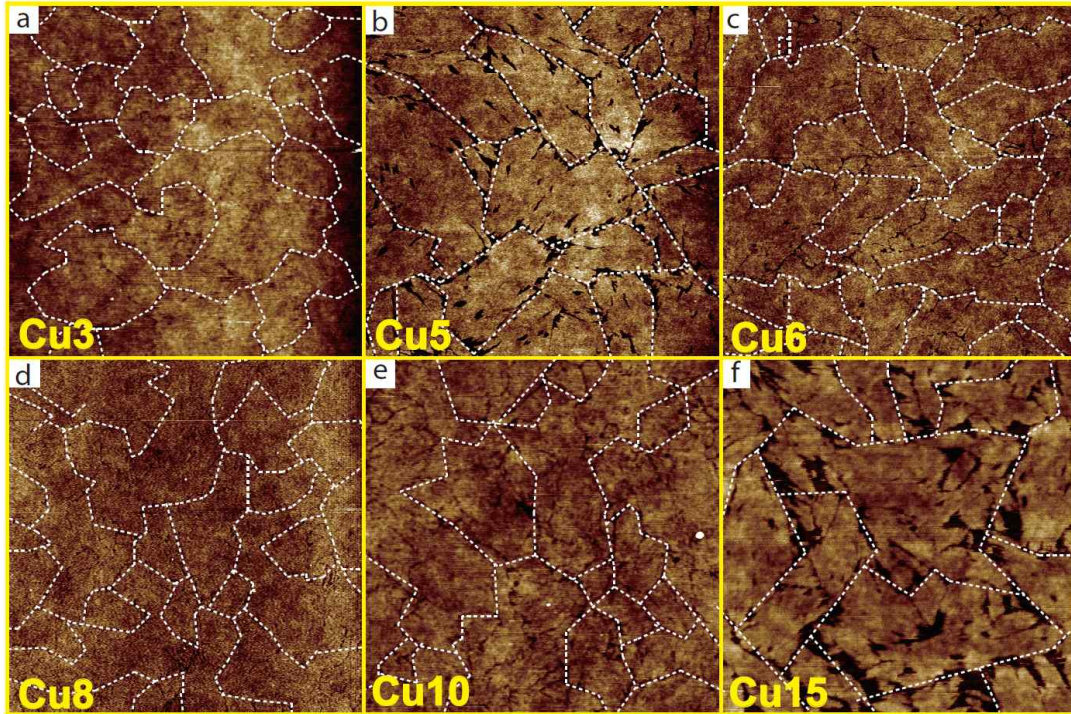
**Table S2.** Sticky-ends for the double-crossover (DX) tiles shown in **Figure S2**

	5' to 3'	3' to 5'	
S1	TGCTA	ACGAT	S1'
S2	CTAGT	GATCA	S2'
S3	TCACT	AGTGA	S3'
S4	CATAC	GTATG	S4'

**Figure S3.** The schematic diagram of  $\text{Cu}^{2+}$  adding (**a**) before and (**b, c**) after annealing.



**Figure S4.** (a-f) The AFM images of the DNA thin films with 3, 5, 6, 8, 10 and 15 mM  $[\text{Cu}^{2+}]$ . The  $\text{Cu}^{2+}$  was added after hybridization. All AFM image scan sizes were  $2.5 \times 2.5 \mu\text{m}^2$ .



**Figure S5.** The variation of magnetization with temperature for piranha-treated glass (PG) (inset) and 5 mM of  $\text{Cu}^{2+}$  (Cu5) on PG without DNA thin films.

