

Optically controlled large-coercivity room-temperature thin-film magnets

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Supporting Information

Table S1. Summary of $[(\text{FeCl}_3+\text{H}_2\text{O})_m+(\text{FeCl}_3+\text{AZO})]_n+(\text{FeCl}_3+\text{H}_2\text{O})_m$ films studied: film thickness values were determined by XRR for films with fewer molecular layers ($n < 10$); for the films with $n \geq 10$, the film thickness value [given in brackets] is an estimate based on the number of ALD/MLD cycles applied.

Sample	n	m	Total number of ALD/MLD cycles [(n × m) + m]	Total film thickness (nm)	Individual $\epsilon\text{-Fe}_2\text{O}_3$ -layer thickness (nm)
n=0 (50 nm)	0	810	810	50	50.0
n=2 (19 nm)	2	300	902	56.6	18.6
n=3 (19 nm)	3	300	1203	75.1	18.6
n=4 (15 nm)	4	250	1254	85.0	15.5
n=6 (15 nm)	6	250	1756	105.7	15.5
n=8 (15 nm)	8	250	2258	131.4	15.5
n=10 (15 nm)	10	250	2760	[171]	15.5
n=10 (3 nm)	10	50	560	[34.7]	3.1
n=15 (12 nm)	15	200	3215	[199]	12.4
n=20 (9 nm)	20	150	3170	[197]	9.3
n=25 (3 nm)	25	50	1325	[82.2]	3.1
n=60 (2 nm)	60	32	1952	[121]	2.0
n=100 (1 nm)	100	17	1717	[106]	1.05

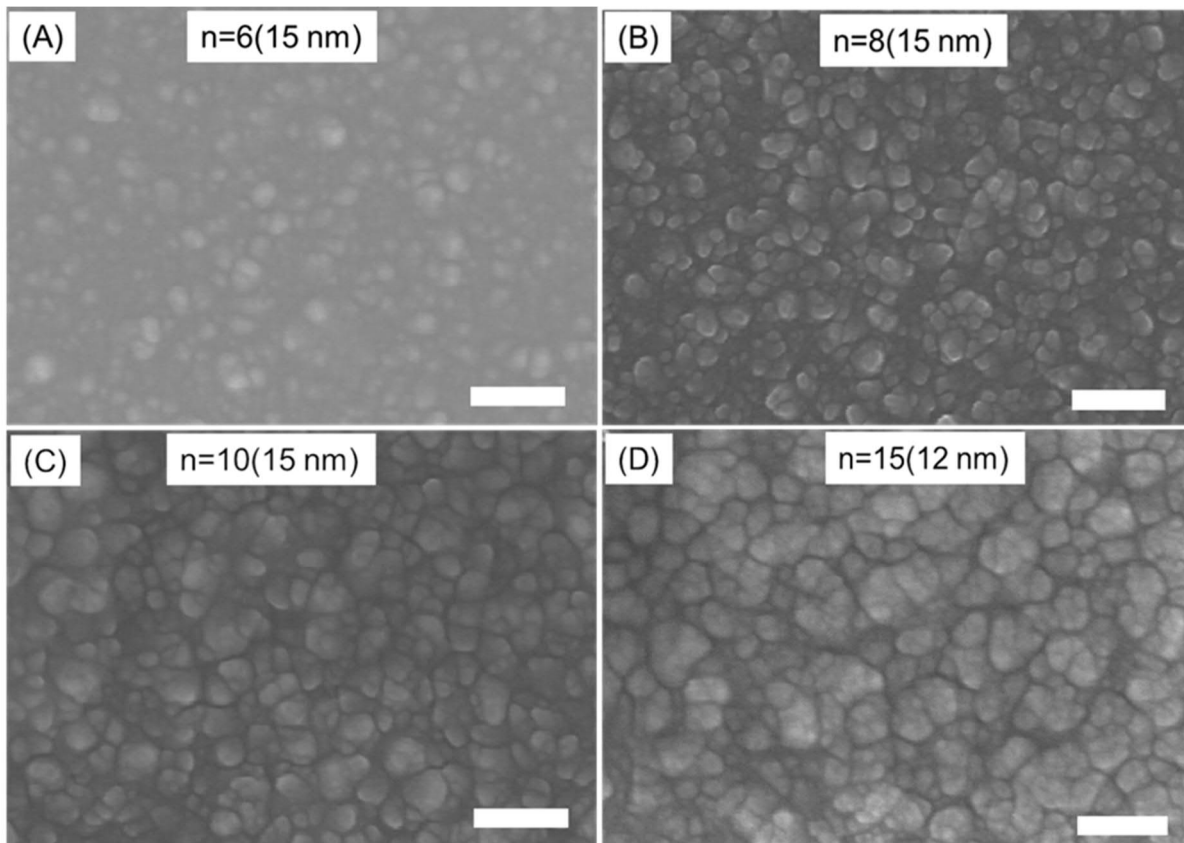


Figure S1. Top-view SEM images for representative ϵ - Fe_2O_3 :azobenzene SL films; sample name indicates both the number of azobenzene layers (n) and the individual ϵ - Fe_2O_3 -layer thickness (in parentheses). Each scale bar is 250 nm.

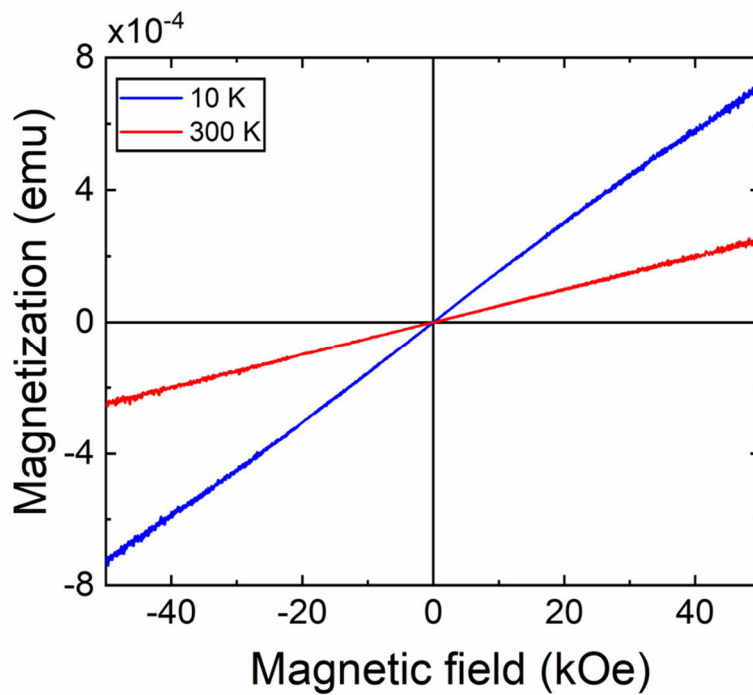


Figure S2. Magnetization versus magnetic field isotherms measured at various temperatures for ca. 200 nm thick Fe-azobenzene film grown from FeCl_3 and AZO; the linear M-H curve shape confirms the paramagnetic behaviour.

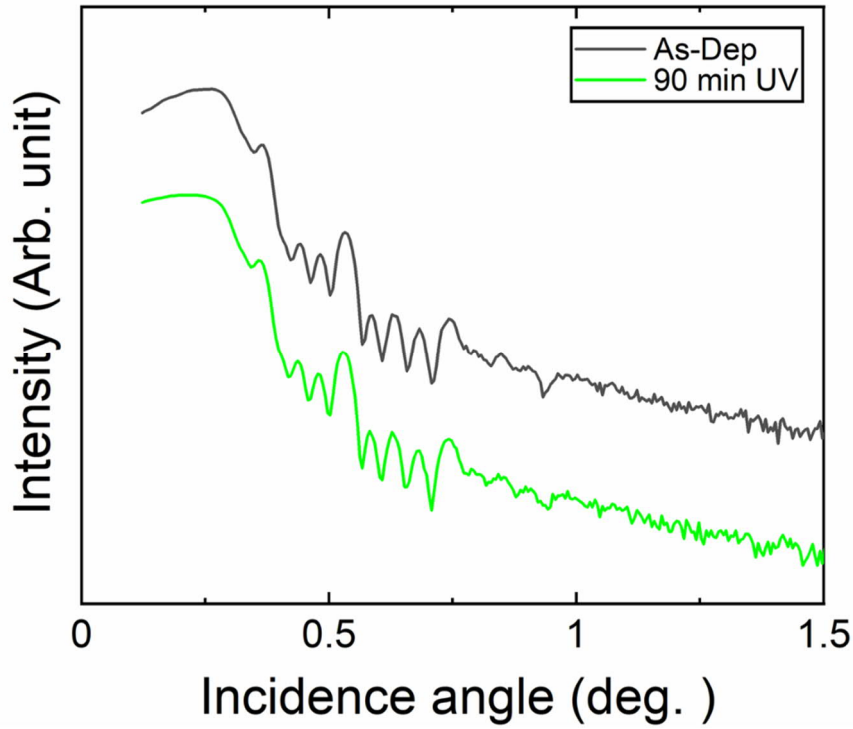


Figure S3. Effect of UV irradiation on the structural properties of ϵ -Fe₂O₃:azobenzene SL films. XRR data for n=3 (19 nm) film before and after 90-min UV irradiation (365 nm); no significance changes in the SL structure are seen.

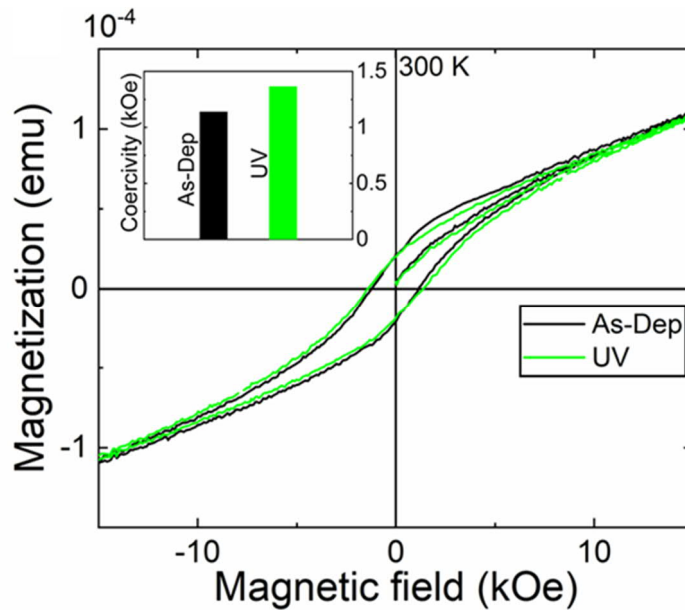


Figure S4. M-H curves for the n=100 (1 nm) SL film before and after UV (20 min) irradiation; the inset shows the changes in coercivity with the irradiation.

Table S2. Coercivity and remnant magnetization values for two representative samples, $n=60$ (2 nm) and $n=100$ (1 nm), taken from the measured raw data without the diamagnetic background (substrate) signal subtraction; the coercivity values in parentheses are the corresponding values after the subtraction.

Sample	Treatment	Coercivity [Oe]; (value after substrate subtraction)	Remnant magnetization [$\times 10^{-5}$ emu]
$n=60$ (2 nm)	As-deposited	1266 (970)	1.88
	UV-irradiated	1358 (1060)	1.94
	UV-Vis-irradiated	1282 (990)	1.86
$n=100$ (1 nm)	As-deposited	1631 (1140)	2.18
	UV-irradiated	2058 (1365)	2.25

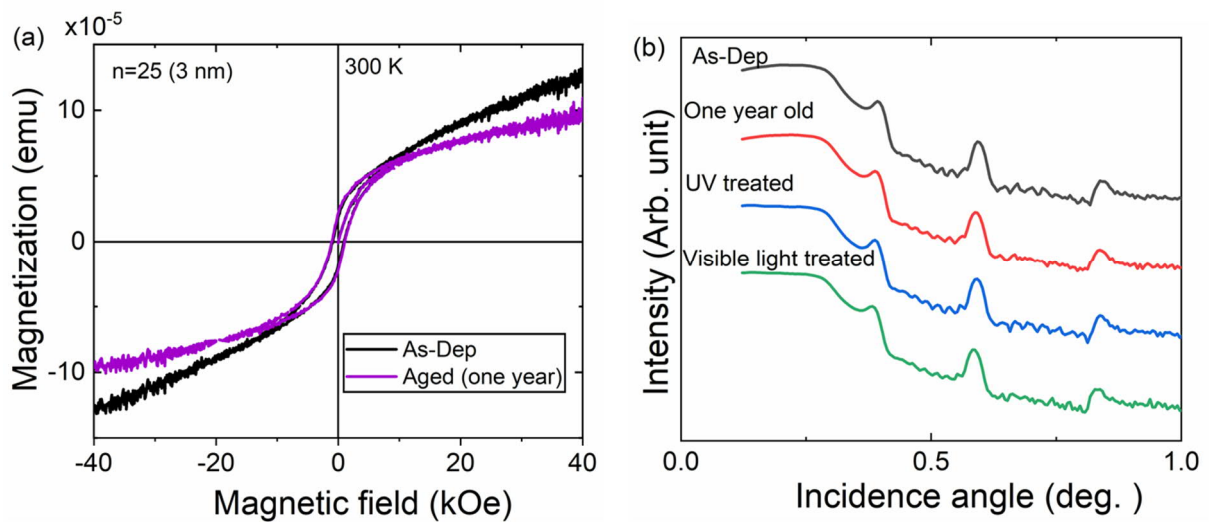


Figure S5. Effect of aging on the magnetic and structural properties of $\epsilon\text{-Fe}_2\text{O}_3\text{:azobenzene}$ SL films. (a) M-H curves for as-deposited and one-year aged $n=25$ (3 nm) film. (b) XRR patterns for as-deposited and aged $n=8$ (15 nm) film, and also for the same film after 120 min UV irradiation followed by 120 min visible light irradiation; no significance changes seen.