Green Synthesis of Ultrathin 2D Nanoplatelets, Hematene and Magnetene, from Mineral Ores in Water, with Strong Optical Limiting Performance

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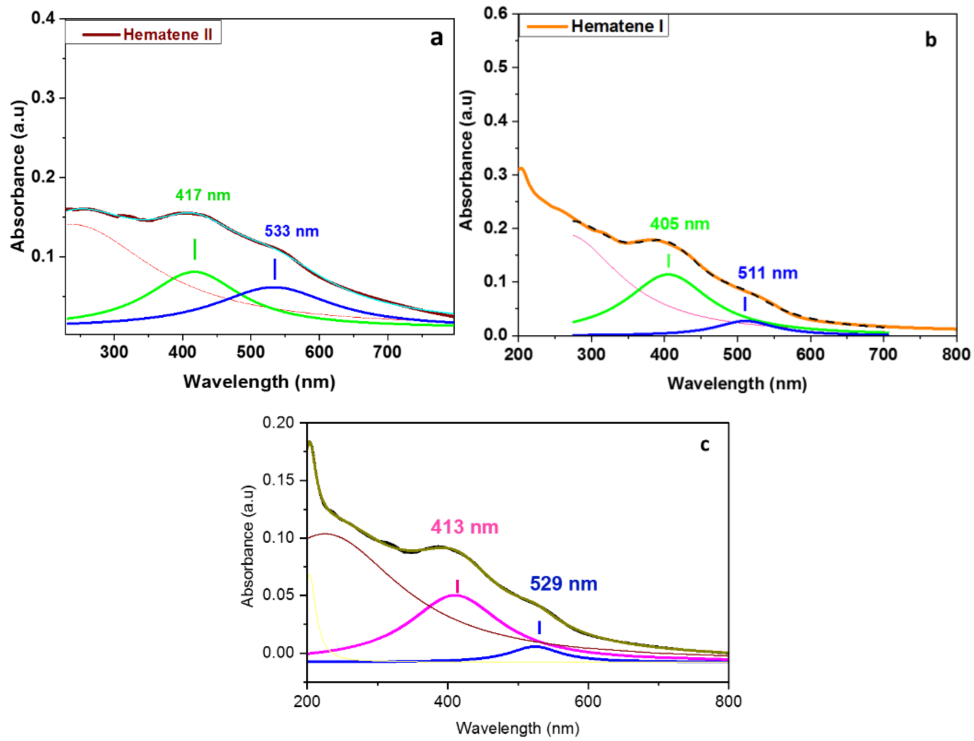
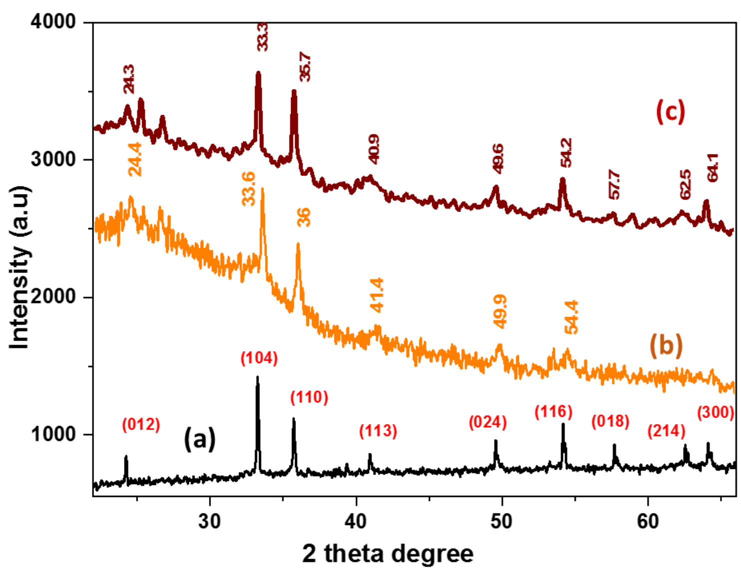


Figure S1. Deconvoluted UV-Vis spectra of a) Hematene II b) Hematene I and c) Hematene-H_2O.



	Hematite	Hemat I	Hemat II
(012)	24.3	24.4	24.3
(104)	33.3	33.6	33.3
(110)	35.6	36	35.7
(113)	40.9	41.2	40.9
(024)	49.6	49.9	49.6
(116)	54	54.3	54.2
(018)	57.7		57.7
(214)	62.6		62.5
(300)	64.2		64.1

Figure S2. XRD pattern of (a) hematite 3D crystal, 2D nanoplatelets Hematene I (b) and II (c).

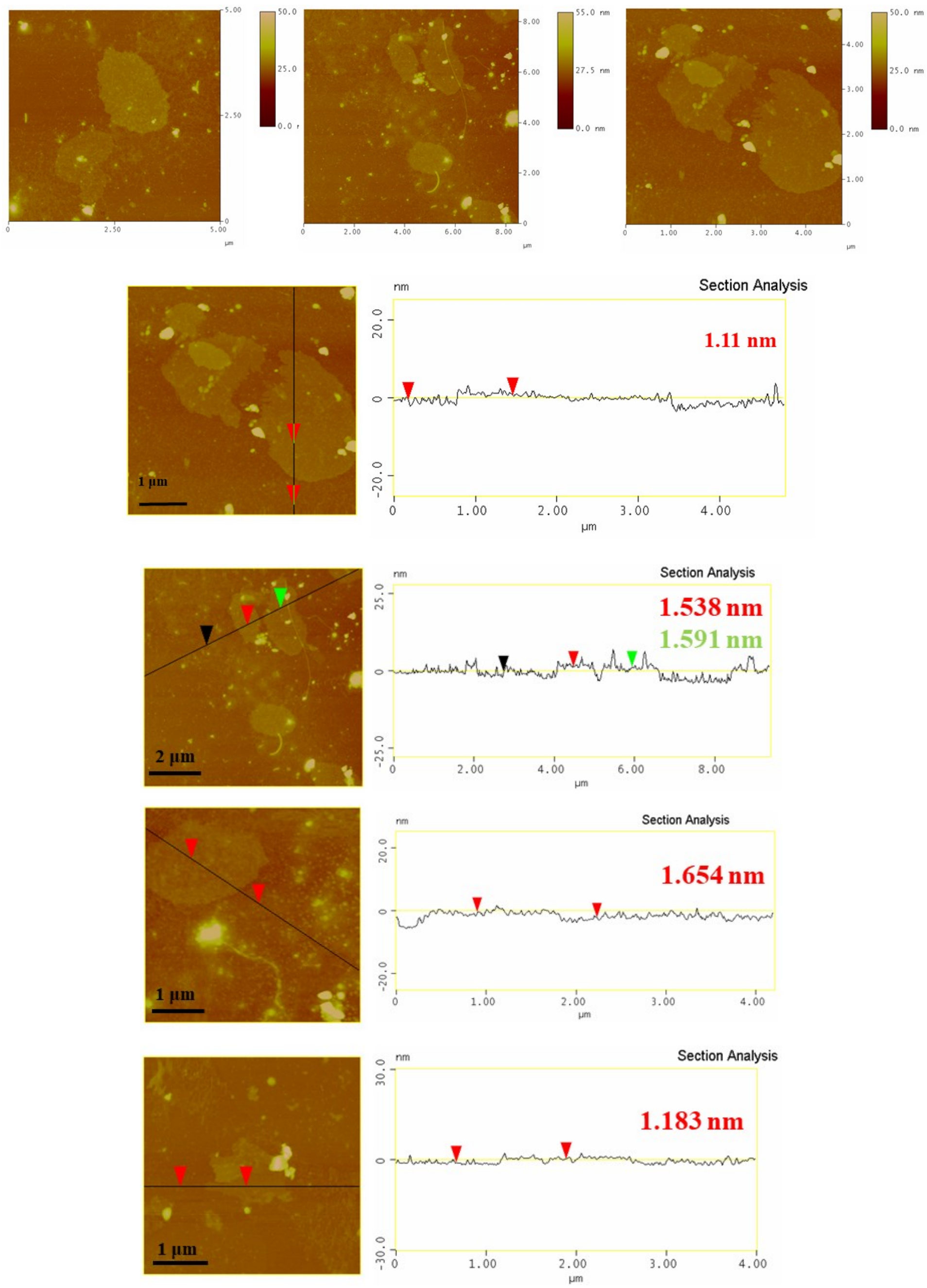


Figure S3. AFM images and high profile of Hematene I

The IR spectrum of melamine consisted of four bands at 3115 (sym), 3320 (asym), 3415 and 3466 cm^{-1} due to NH_2 stretching vibrations[1,2,3,4], and bands at 1630 cm^{-1} (NH_2 deformation[1] or bending vibrations[2,3,4]), at 1520 and 1425 cm^{-1} (ring streching[1,4] or NH_2 bending and C-N stretching[2,3]), at 1020 (ring deformation and NH rocking vibrations[2]) and at 807 cm^{-1} (out-of-plane ring deformation[2,4]). The broad band of Hematene spectrum at 950 cm^{-1} are attributed to Fe-OH vibration mode[5].

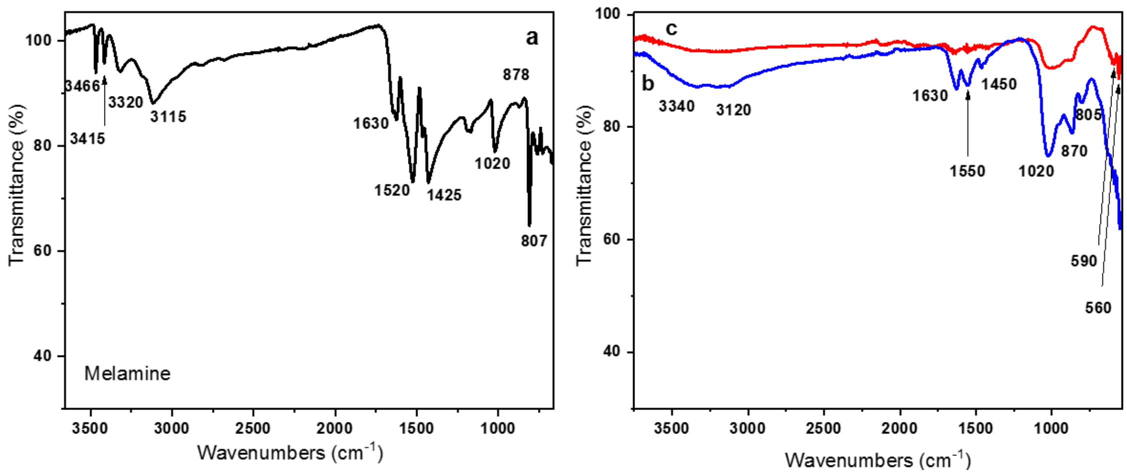


Figure S4. FTIR spectra of a) melamine and b) Hematene isolated by filtration after the exfoliation of hematite in a water solution of melamine.

The X-ray diffraction pattern of magnetite presented in Figure S5 contains six strong diffraction peaks at 2 θ = 30.2°, 35.5°, 43.2°, 53.5°, 57.1° and 62.9°, corresponding to (220), (311), (400), (422), (511), and (440) crystalline planes of magnetite phase, respectively.

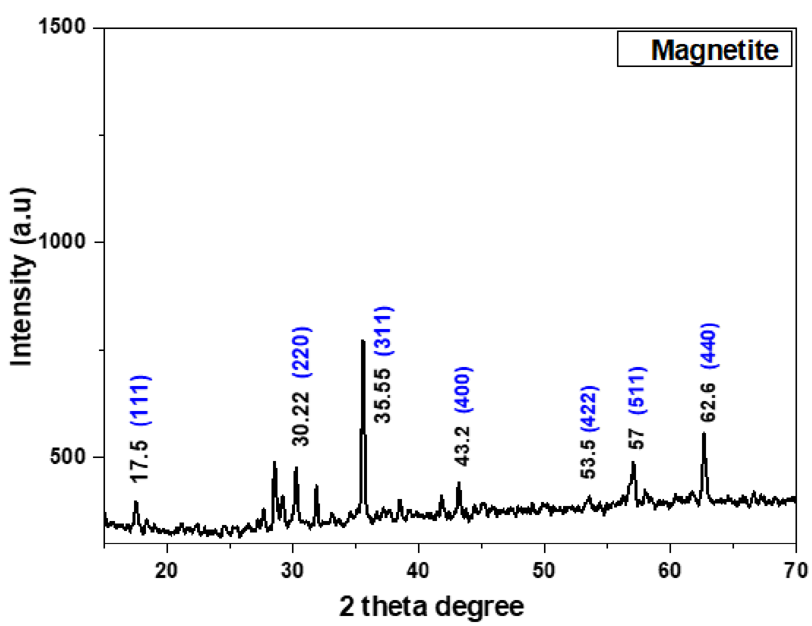


Figure S5. XRD pattern of magnetite ore.

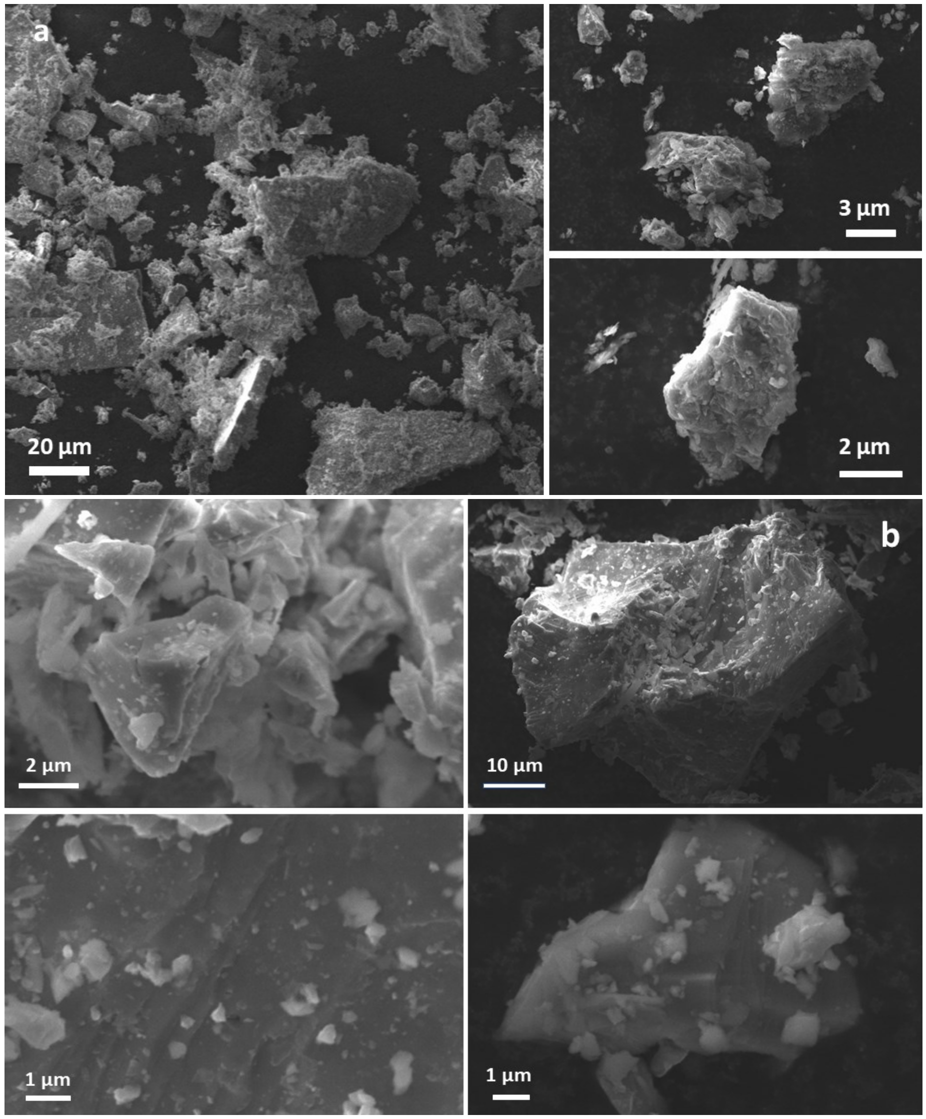


Figure S6. SEM images of a) hematite and b) magnetite.

Table S1. OL_{on} values of hematene, magnetene, graphene, graphene oxide, MoS_2, WS_2, $MoSe_2$, WSe_2, black phosphorus and antimonene dispersions, using ns laser irradiation at 532 nm.

Sample	T (%)	OL_{on} (J/cm^2)	Ref.
Hematene	93	0.34	this work
Magnetene	93	0.44	this work
Graphene	79.7	0.44	(6)
Graphene Oxide	50	0.4	(7)
MoS_2	63.8	1.52	(6)
WS_2	55.1	1.24	

$MoSe_2$	25.3	1.47	
WSe_2	37.2	0.99	
Black Phosphorus	79.7	~4.5	(8)
Antimonene	83	0.162	(9)

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