Supporting Information

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Amine-based synthesis of Fe_3C nanomaterials: mechanism and impact of synthetic conditions

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# These authors contributed equally to this work

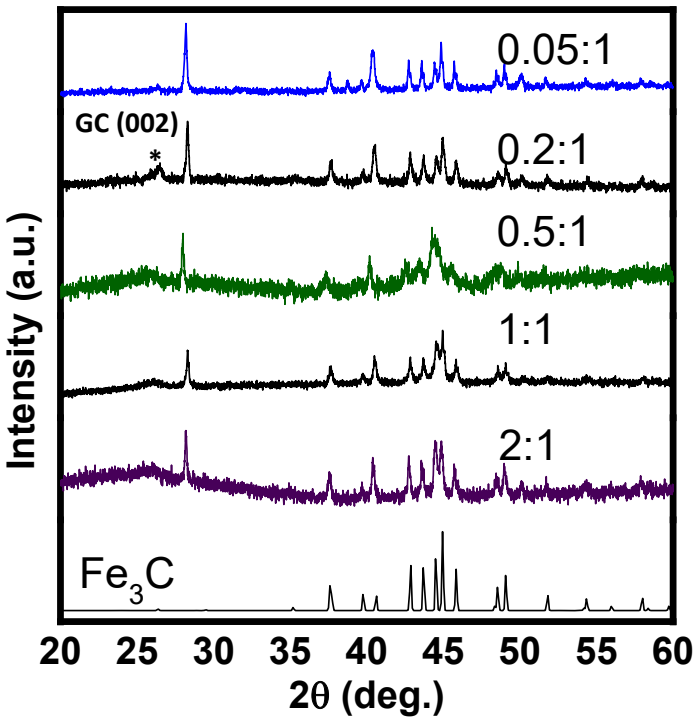


Figure S1: XRD patterns of Fe_3C made from *m*PDA at 750 °C for 0 s dwell time with different Fe : amine ratio (1:2, 1:1, 1:0.5, 1:0.2, and 1:0.05). The reference data at the bottom of the figure for Fe_3C was reproduced from PDF: 00-006-0688.

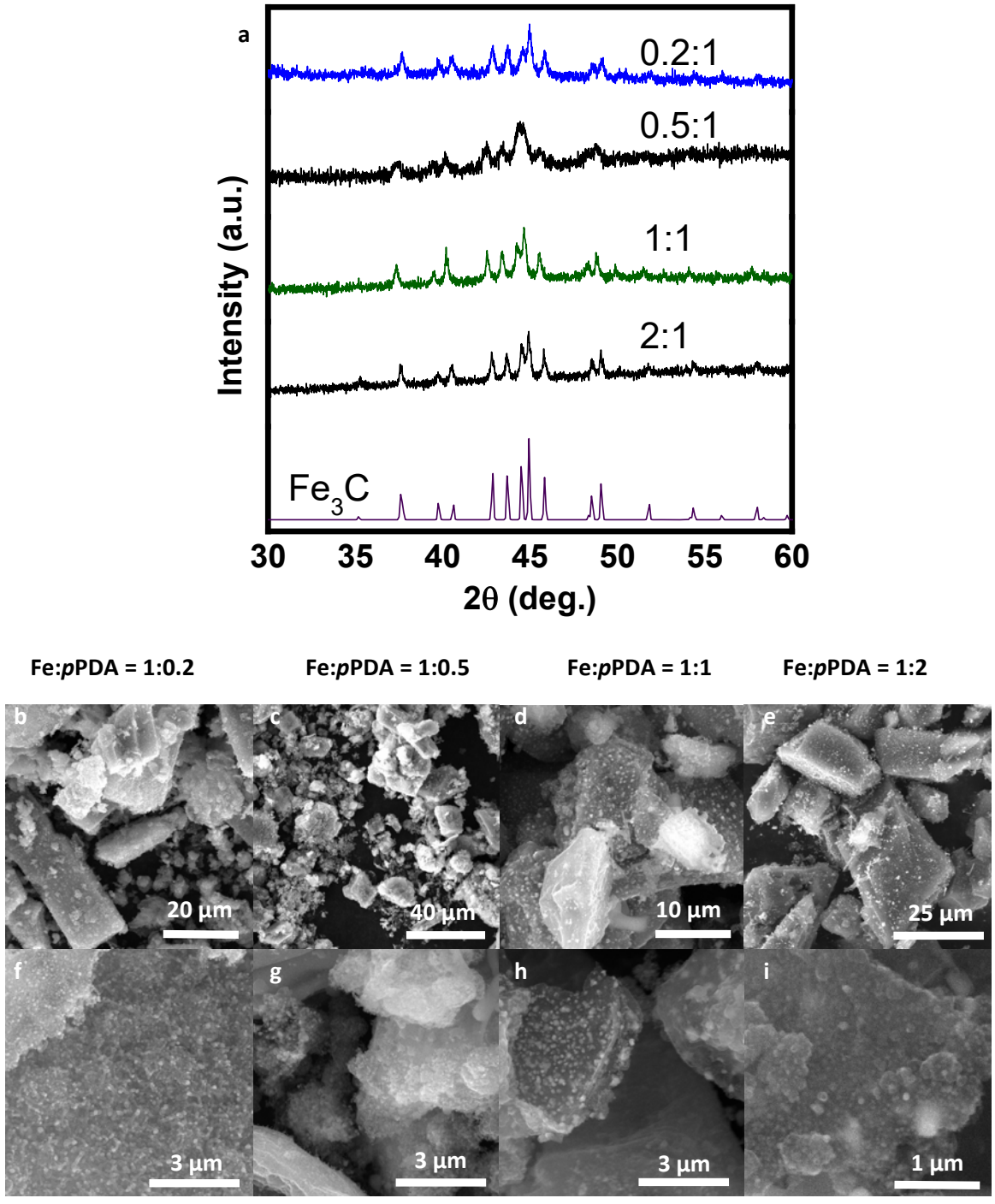
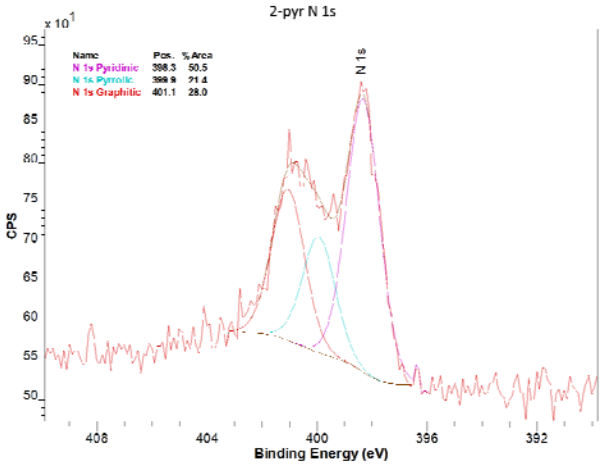


Figure S2: XRD patterns (a) and SEM images (b)–(i) of Fe_3C made from *p*PDA at 750 °C with a 0 s dwell time with different Fe : amine ratios (1:2, 1:1, 1:0.5, and 1:0.2). The reference data at the bottom of Figure (a) for Fe_3C was reproduced from PDF: 00-006-0688. (b)–(i) SEM images of the different Fe : amine ratios with low magnification images on the top and high magnification images of the same sample on the bottom.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x 10^1
CPS
Binding Energy (eV)
N 1s
Name Pos. % Area
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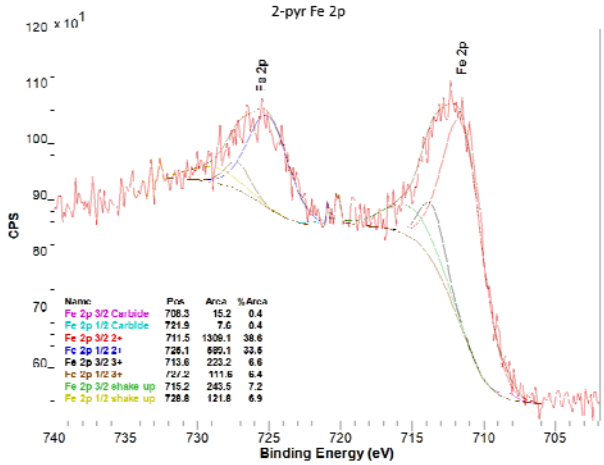
N 1s Pyrrolic 399.9 21.4
N 1s Graphitic 401.1 28.0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x 10^1
CPS
Binding Energy (eV)
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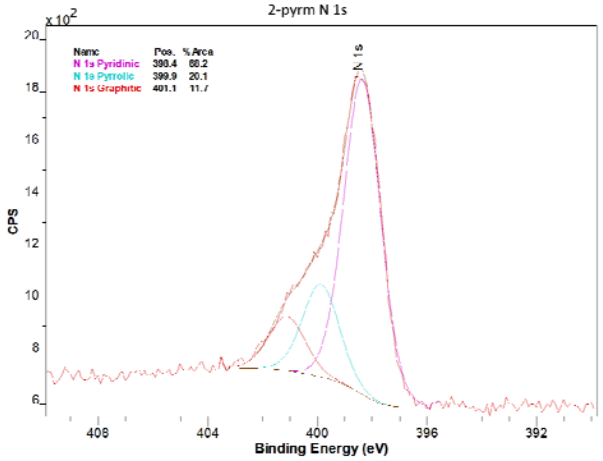
Fe 2p 1/2 Carbide 721.9 7.6 0.4
Fe 2p 3/2 2+ 711.5 1309.1 38.6
Fe 2p 1/2 2+ 726.1 680.1 33.5
Fe 2p 3/2 3+ 713.6 223.2 6.6
Fe 2p 1/2 3+ 727.2 111.6 6.4
Fe 2p 3/2 shake up 715.2 243.5 7.2
Fe 2p 1/2 shake up 728.8 121.8 6.9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CPS
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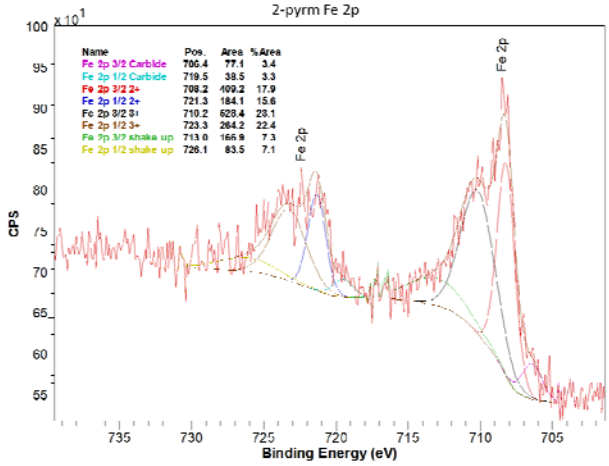
N 1s Graphitic 401.1 11.7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x 10^1
CPS
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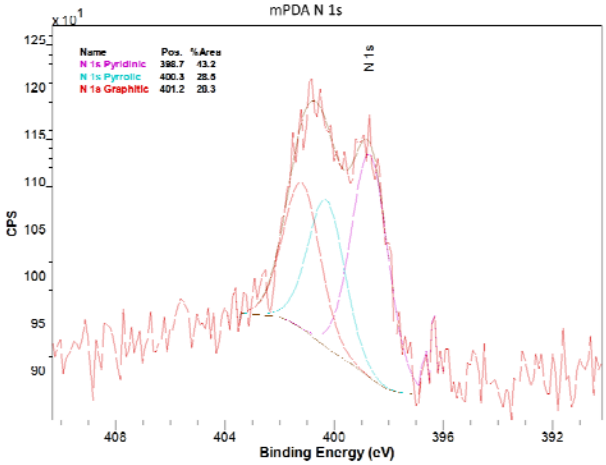
Fe 2p 3/2 2+ 709.2 409.2 17.9
Fe 2p 1/2 2+ 721.3 184.1 15.6
Fe 2p 3/2 3+ 710.2 628.4 28.1
Fe 2p 1/2 3+ 723.3 264.2 22.4
Fe 2p 3/2 shake up 713.0 166.9 7.3
Fe 2p 1/2 shake up 726.1 83.5 7.1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CPS
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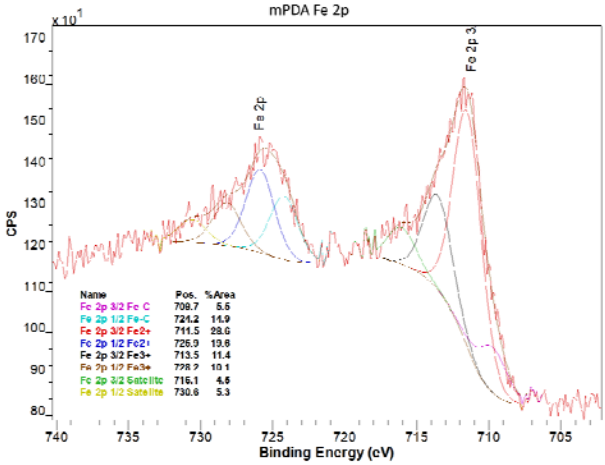
N 1s Pyrrolic 400.3 28.5
N 1s Graphitic 401.2 28.3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x 10^1
CPS
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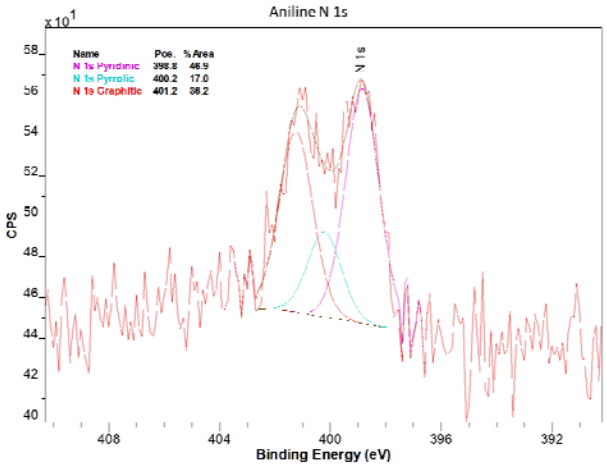
Fe 2p 3/2 Fe2+ 711.5 28.0
Fe 2p 1/2 Fe2+ 726.9 13.8
Fe 2p 3/2 Fe3+ 713.5 11.4
Fe 2p 1/2 Fe3+ 728.2 10.1
Fe 2p 3/2 Satellite 716.1 4.5
Fe 2p 1/2 Satellite 730.6 5.3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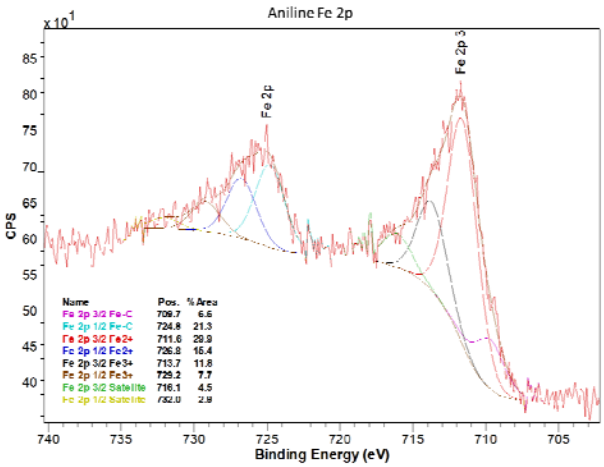
N 1s Pyrrolic 400.2 17.0
N 1s Graphitic 401.2 36.2
N 1s
CPS
Binding Energy (eV)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Fe 2p
Fe 2p 3
Name Pos. % Area
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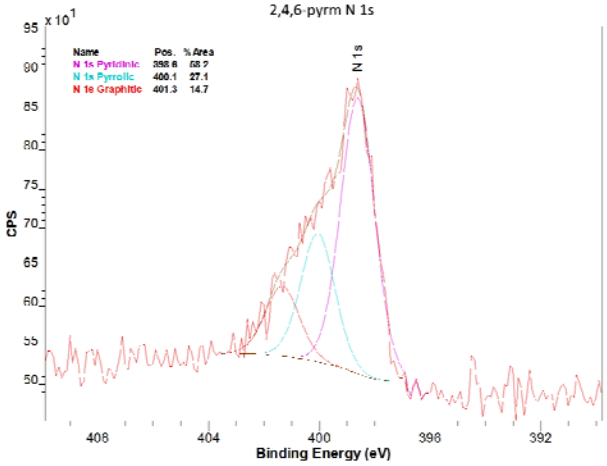
Fe 2p 1/2 Fe-C 724.8 21.3
Fe 2p 3/2 Fe2+ 711.6 29.9
Fe 2p 1/2 Fe2+ 726.8 15.4
Fe 2p 3/2 Fe3+ 713.7 11.8
Fe 2p 1/2 Fe3+ 728.2 7.7
Fe 2p 3/2 Satellite 716.1 4.5
CPS
Binding Energy (eV)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x 10^1
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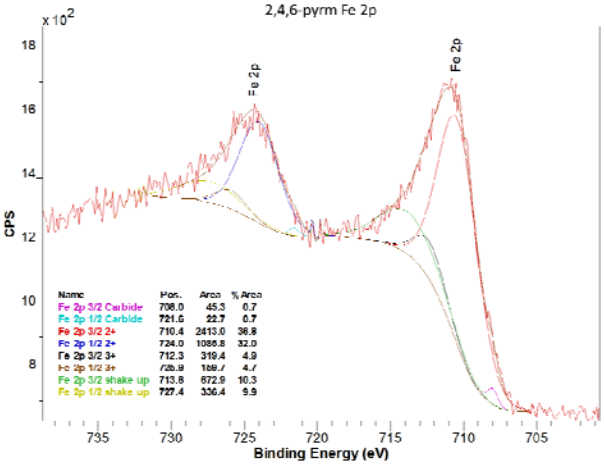
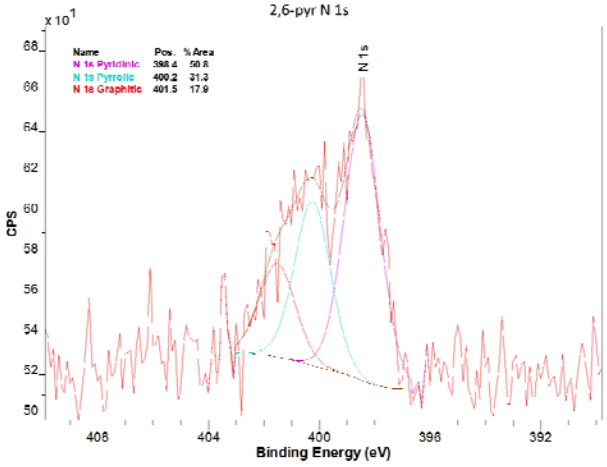
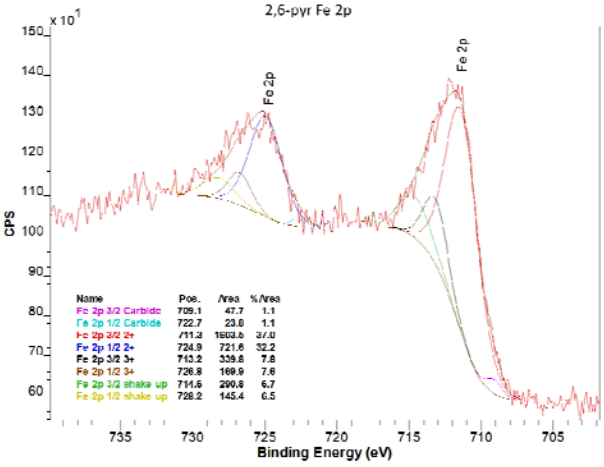
N 1s Pyrrolic 400.1 27.1
N 1s Graphitic 401.3 14.7
N 1s
CPS
Binding Energy (eV)


2,4,6-pyrm Fe 2p
x 10^2
Fe 2p
Fe 2p
Name Pos. Area % Area
Fe 2p 3/2 Carbide 708.0 45.3 0.7
Fe 2p 1/2 Carbide 721.6 22.7 0.7
Fe 2p 3/2 2+ 710.4 2413.0 36.8
Fe 2p 1/2 2+ 724.0 1086.8 32.0
Fe 2p 3/2 3+ 712.3 319.4 4.9
Fe 2p 3/2 shake up 713.8 672.9 10.3
Fe 2p 1/2 shake up 727.4 336.4 9.9
CPS
Binding Energy (eV)


2,6-pyr N 1s
x 10^1
Name Pos. % Area
N 1s Pyridinic 398.4 50.8
N 1s Pyrrolic 400.2 31.3
N 1s Graphitic 401.5 17.9
N 1s
CPS
Binding Energy (eV)


2,6-pyr Fe 2p
x 10^1
Fe 2p
Fe 2p
Name Pos. Area % Area
Fe 2p 3/2 Carbide 709.1 47.7 1.1
Fe 2p 1/2 Carbide 722.7 23.8 1.1
Fe 2p 3/2 2+ 724.9 721.6 32.2
Fe 2p 3/2 3+ 713.2 339.8 7.8
Fe 2p 1/2 3+ 726.8 169.9 7.8
Fe 2p 3/2 shake up 714.6 290.8 6.7
Fe 2p 1/2 shake up 728.2 145.4 6.5
CPS
Binding Energy (eV)

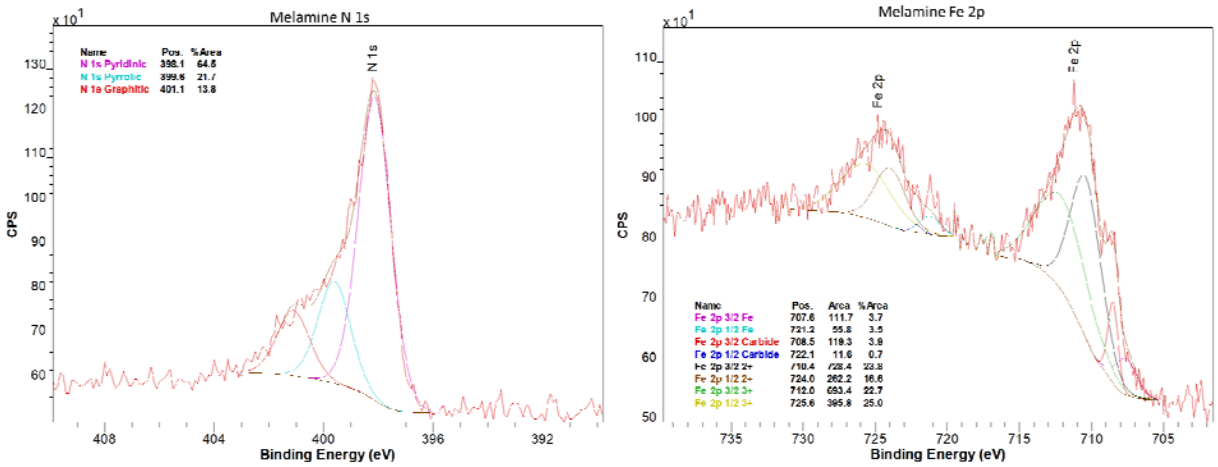


Figure S3: XPS Fe 2*p* and N 1*s* spectra of selected Fe_3C products from different amine precursors.