

X-ray Photoelectron Spectroscopy (XPS)



Contents



WHAT is XPS?

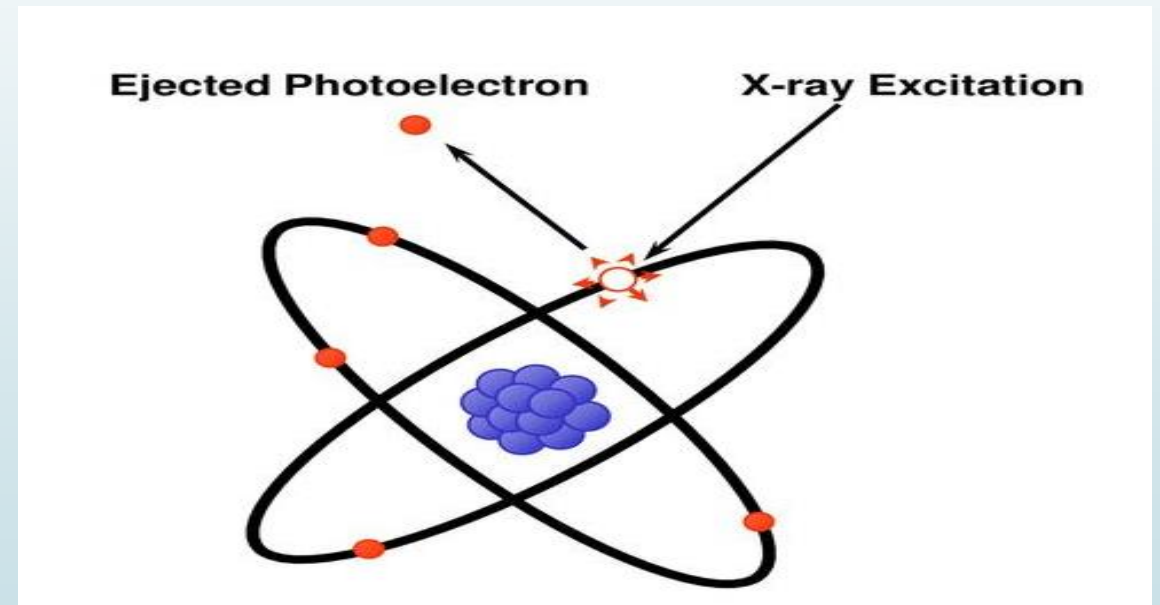
HOW does it work? An in-depth look at each component of the instrument

WHERE can this technique be applied?

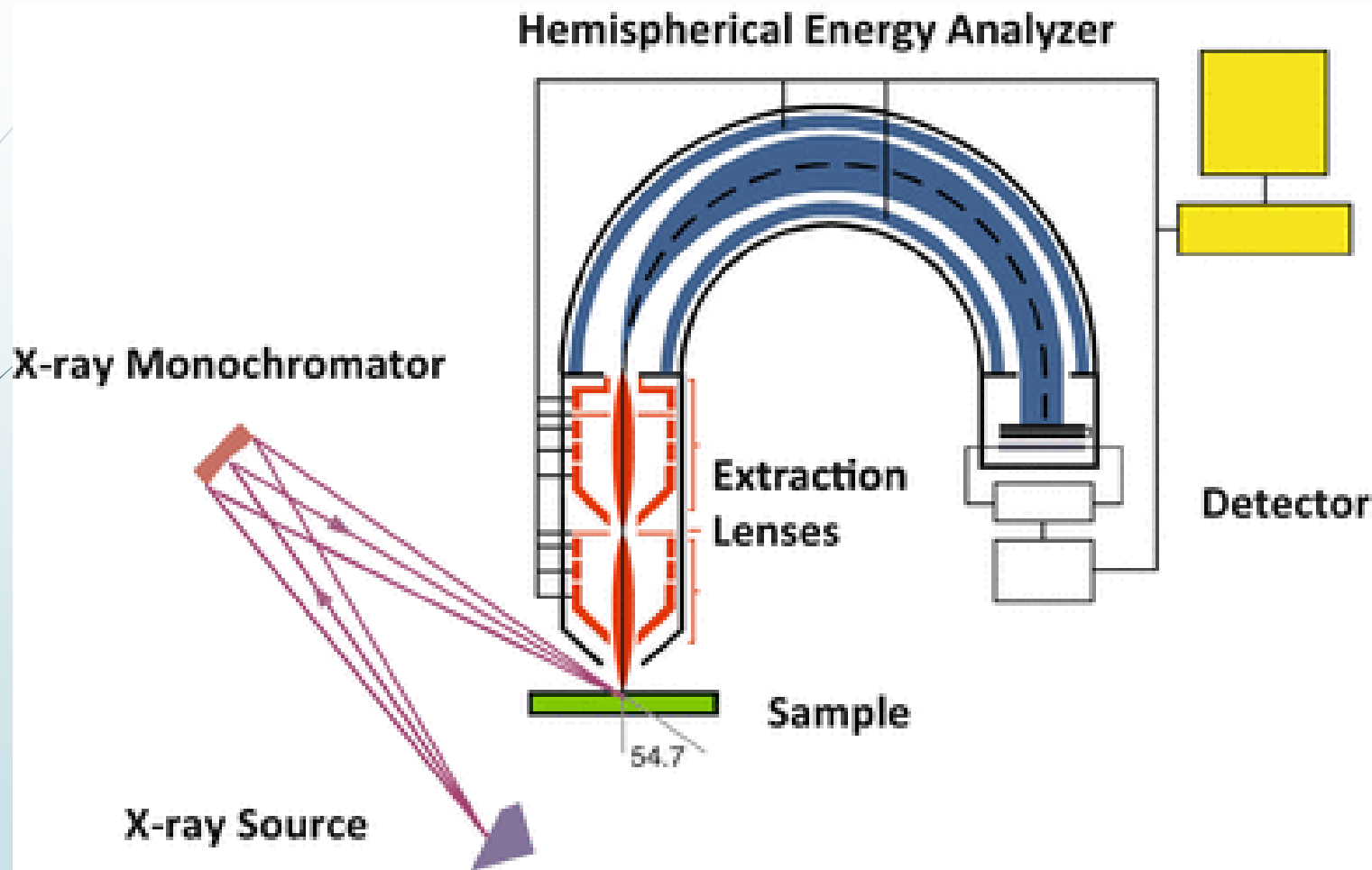


WHAT is XPS?

- Quantitative surface analysis technique
- Provides spatial distribution information via mapping or depth profiling
- Binding energy is measured giving information on the origin of the photoelectron



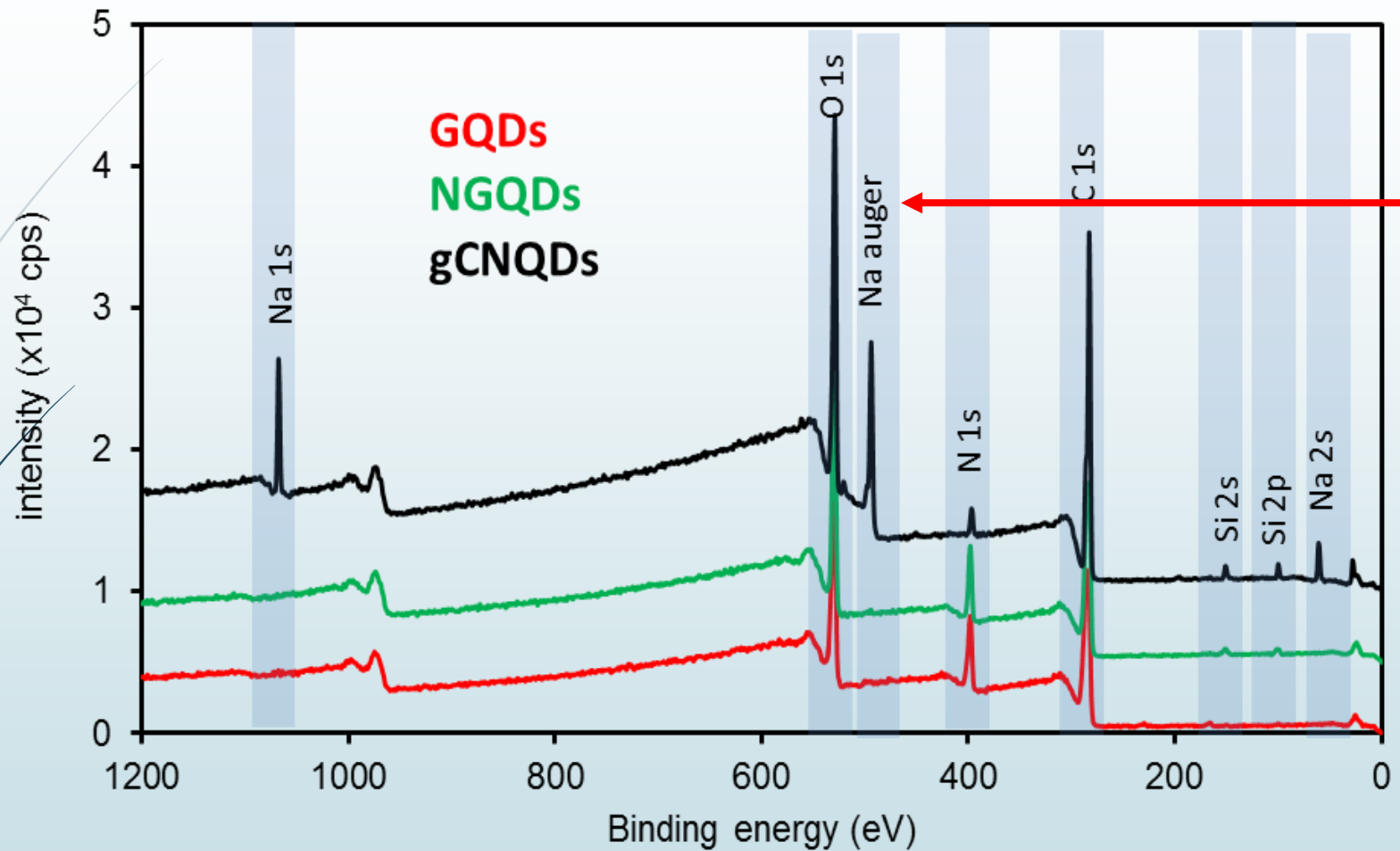
HOW does this instrument work?



A dark grey arrow points to the right from the left edge of the slide. Below it, several thin, curved lines in shades of blue and grey sweep across the left side of the slide.

Applications: Elemental composition in wide scans



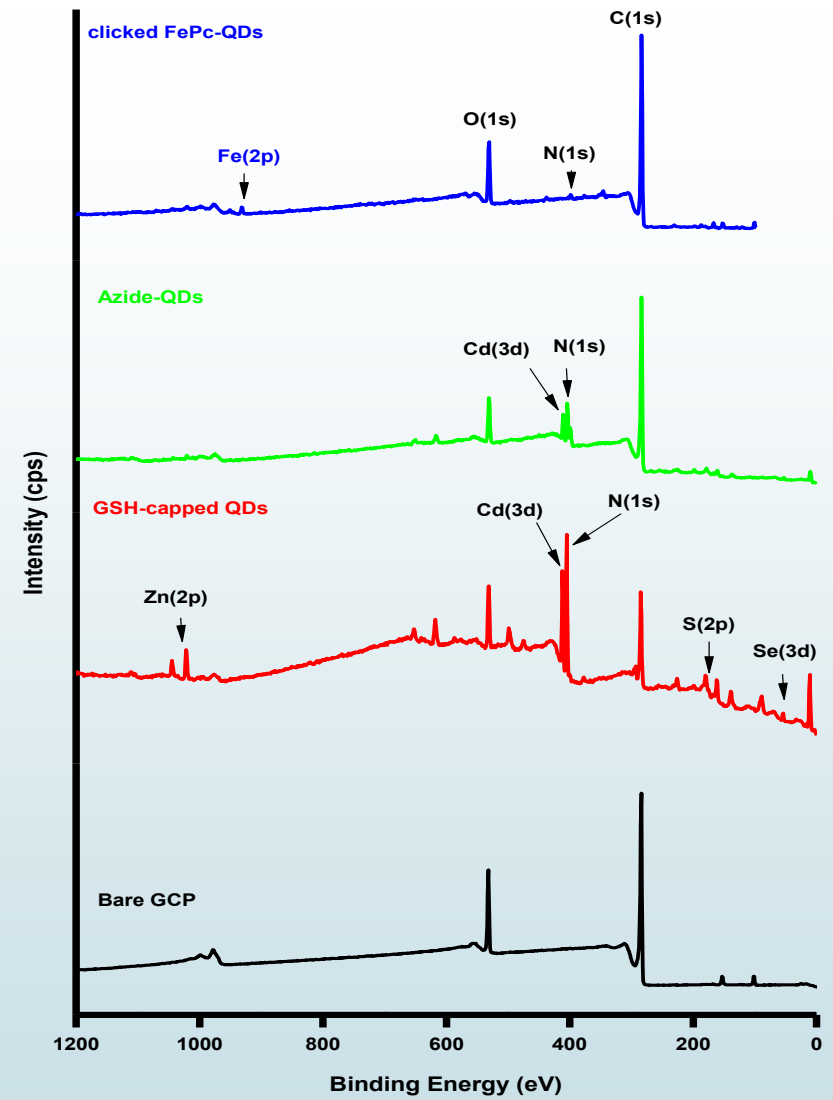
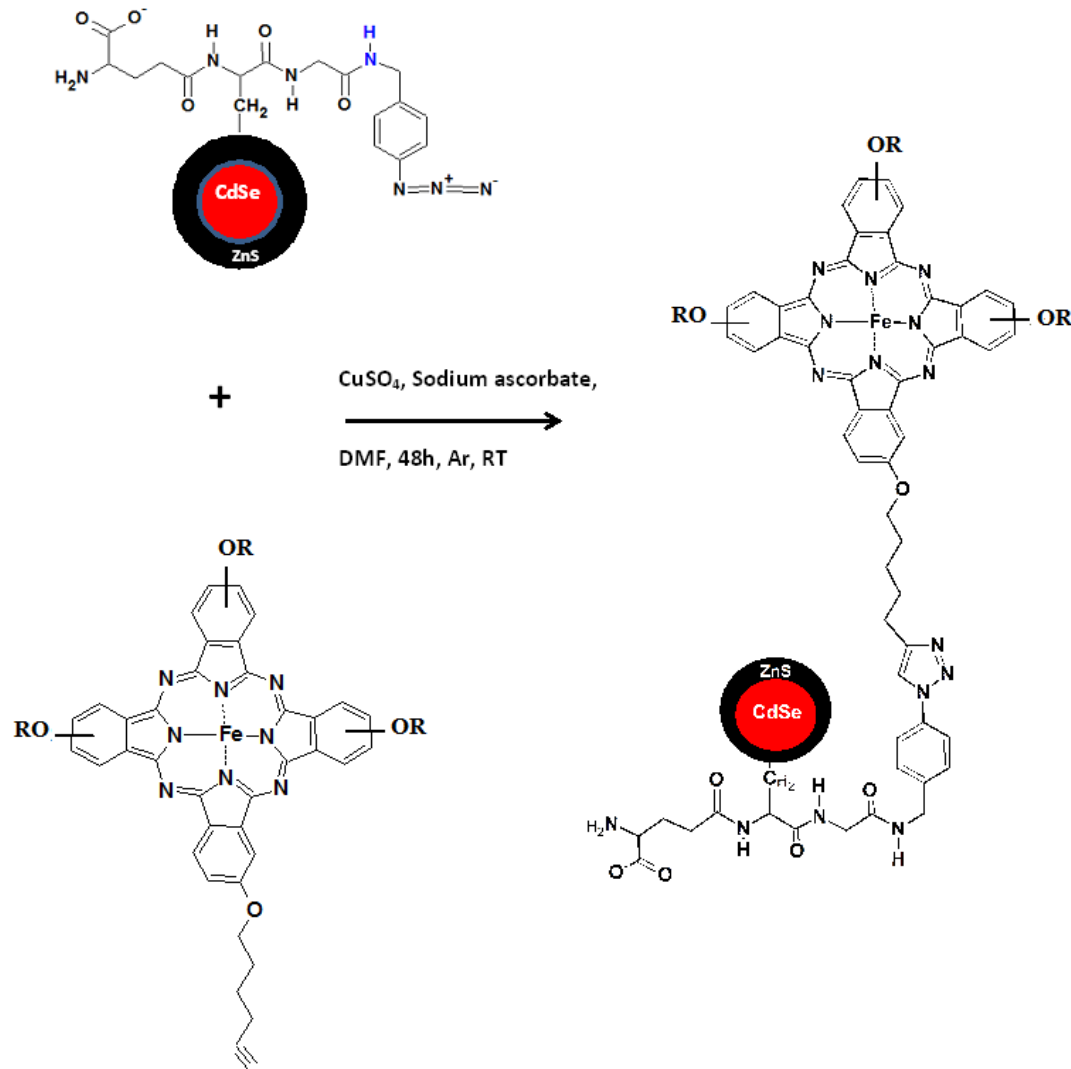


A result of released energy due to atom from higher energy level filling gap of emitted electron from same

Laura Trapiella-Alfonso, Fanny D'Orlye, Philani Mashazi, Anne Varenne*, Tebello Nyokong. Physical and in-solution characterisation of graphitic carbon nitride, graphene and nitrogen-doped graphene quantum dots*, work in progress

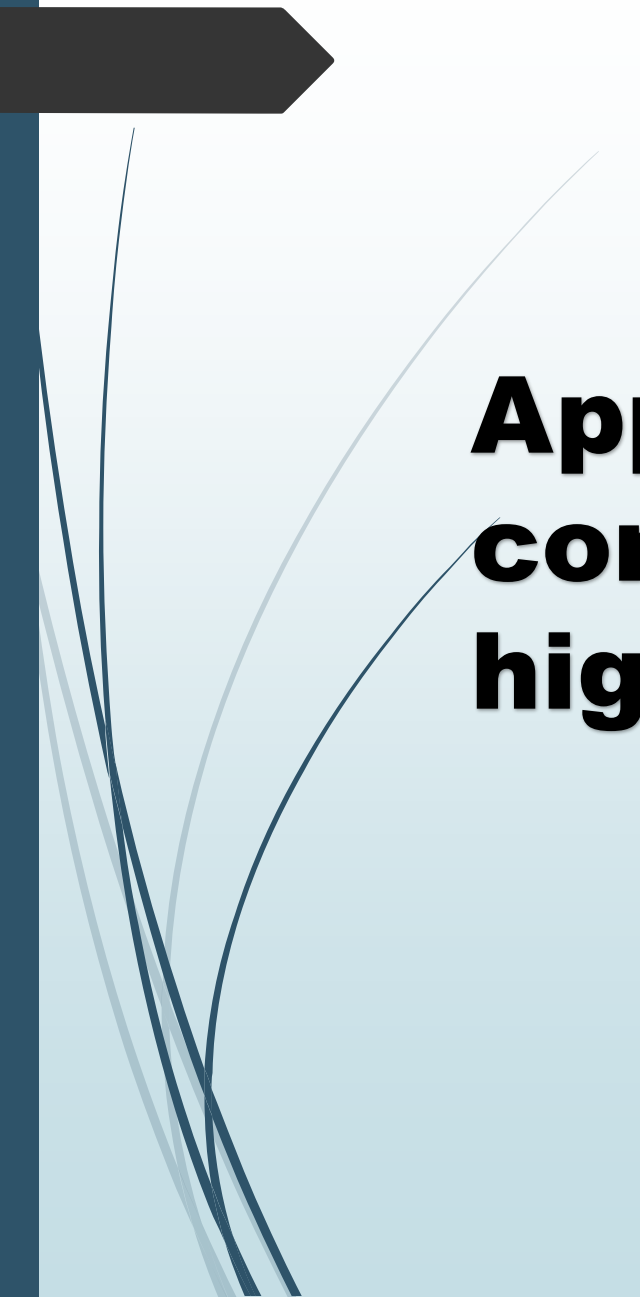


Analysis done on glassy carbon plates



S.R Nxele, T. Nyokong, Conjugation of Azide-functionalised CdSe/ZnS Quantum Dots with Tetrakis(5-hexynoxy) Fe(II) phthalocyanine via Click Chemistry for Electrocatalysis, *Electrochim. Acta* 194 (2016) 26-39.

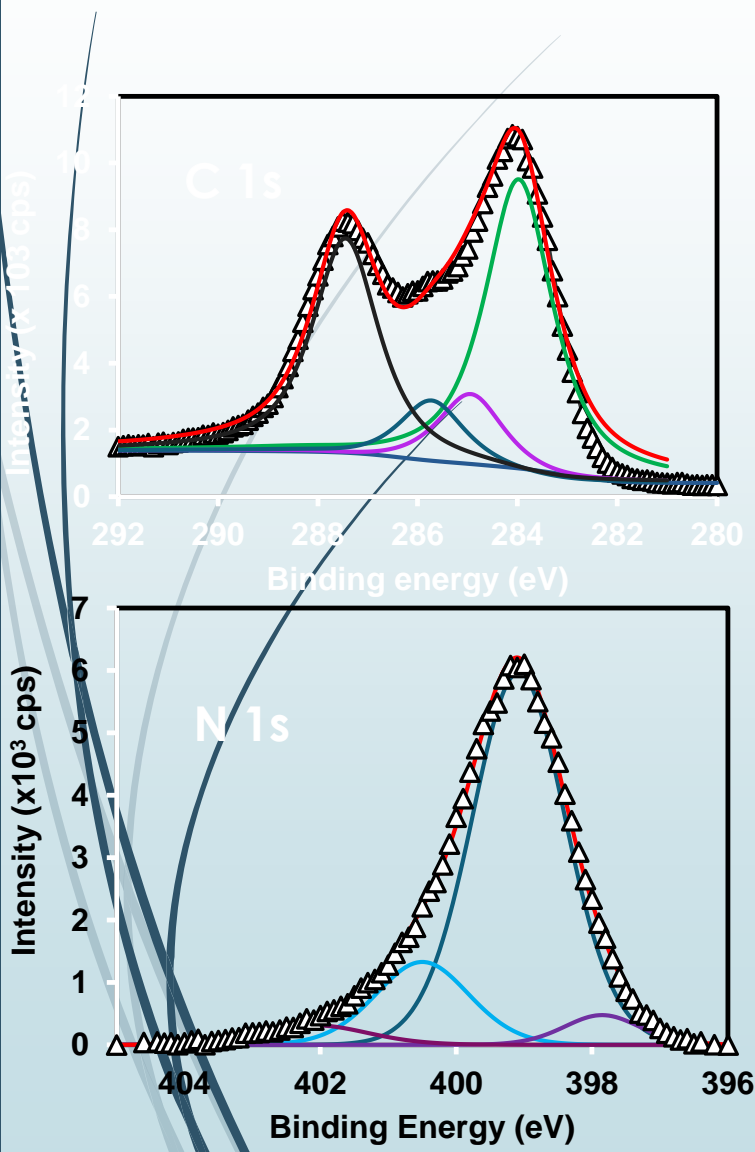
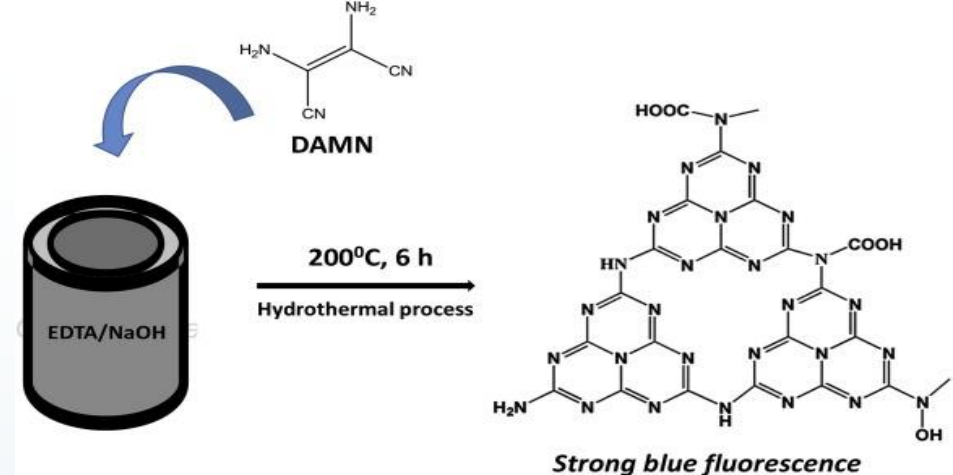


A dark grey arrow points to the right from the left edge of the slide. Several thin, light blue lines curve upwards and to the right from the bottom left corner, framing the text.

Applications: Elemental composition and bond-types in high resolution scans



Physical characterisation: XPS N1s/C1s high resolution scans & $R_{\text{NH}/\text{COOH}}$ values

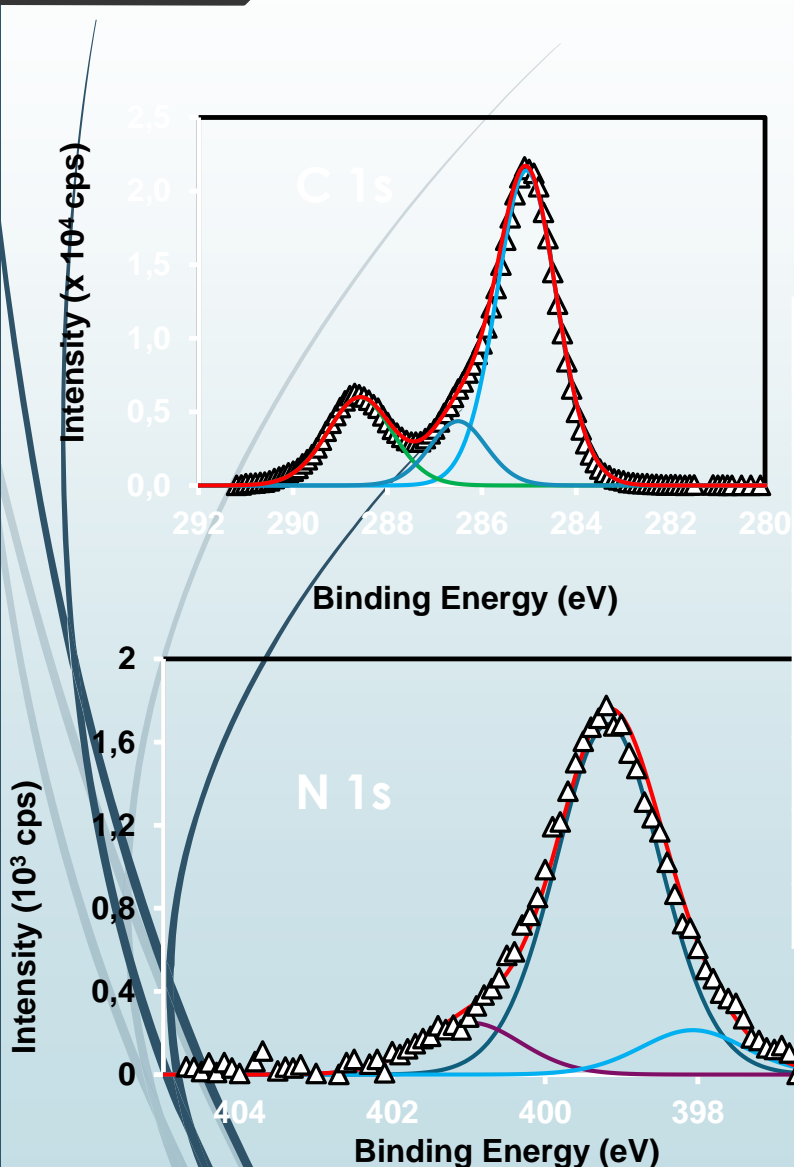
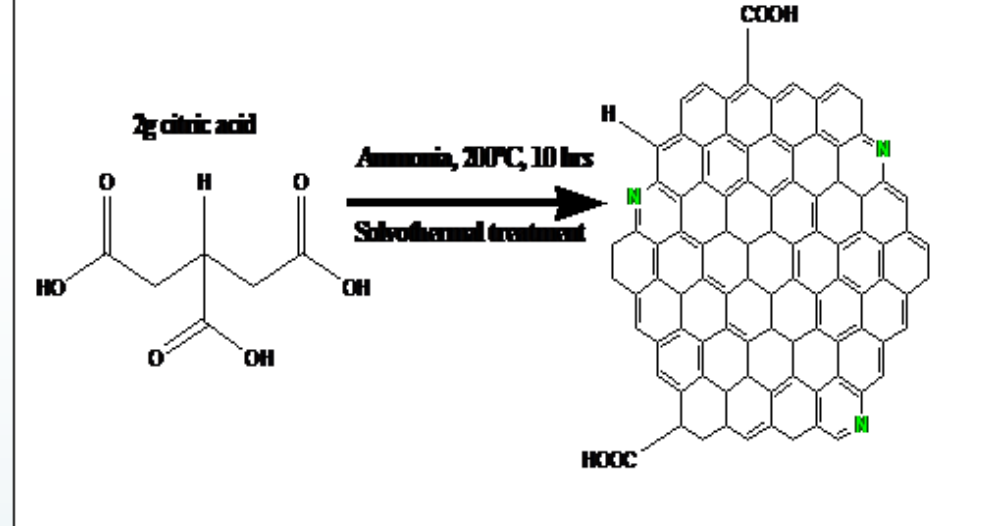


Element	Binding energy (eV)	Peak assignment
C1s	287.5	COOH
	286.2	C-O
	284.8	C=O
	283.9	C=N
N1s	400.9	NH
	402.1	NC=O
	399.3	N=C
	397.4	C-N-C

$$R_{\text{NH}/\text{COOH}} = 0.20$$

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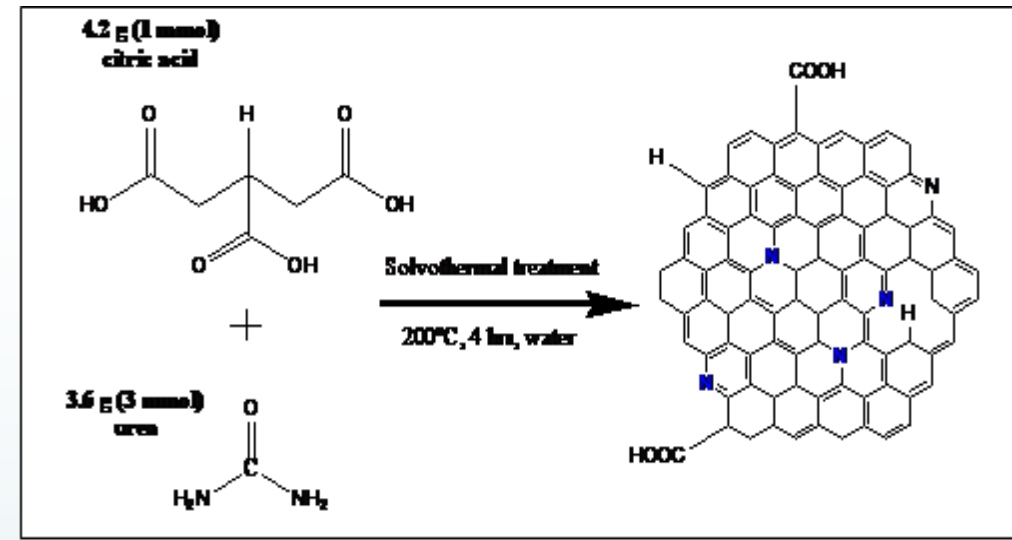
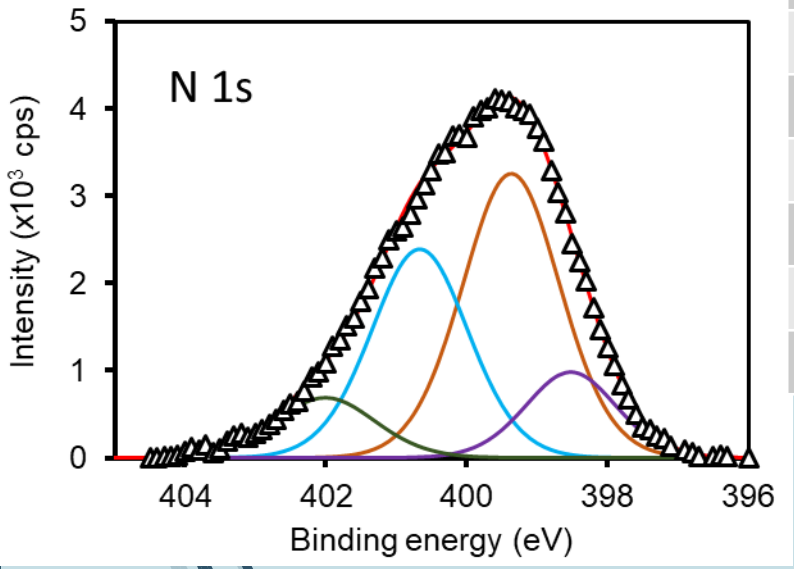
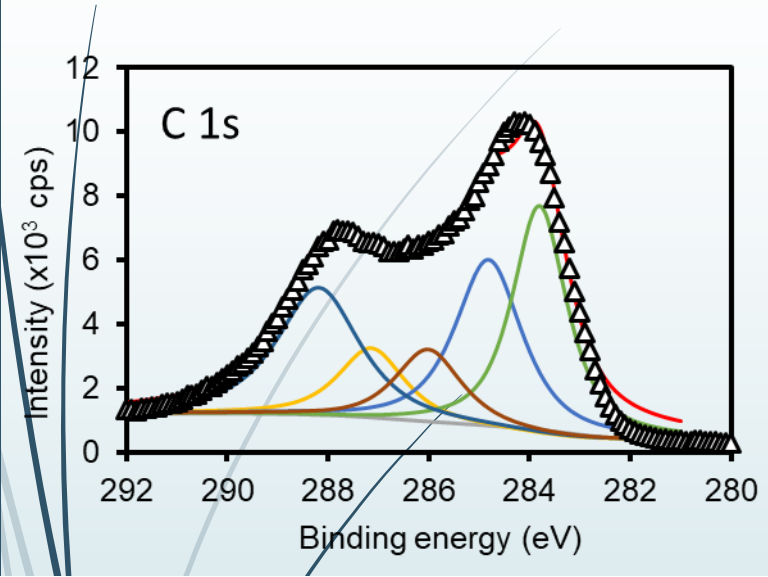
Physical characterisation: XPS N1s/C1s high resolution scans & $R_{\text{NH/COOH}}$ values



Element	Binding energy (eV)	Peak assignment
C1s	288.4	COOH
	286.8	C-O
	284.9	C=N
N1s	401.1	NH
	399.4	N=C
	398.1	C-N-C

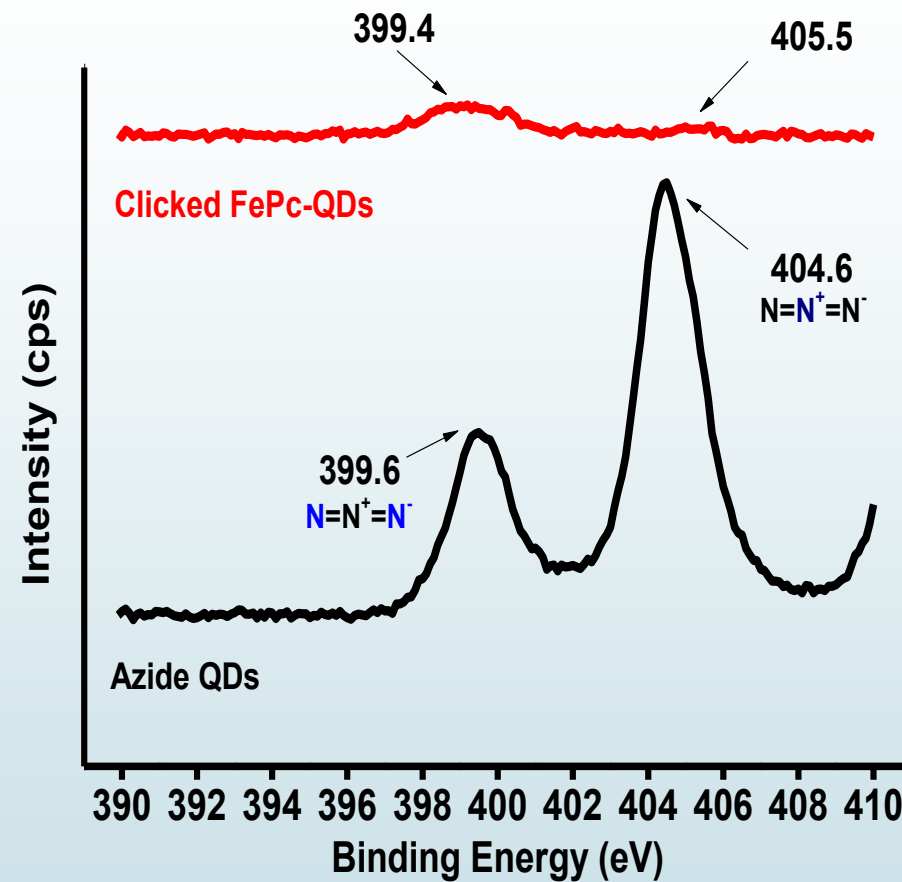
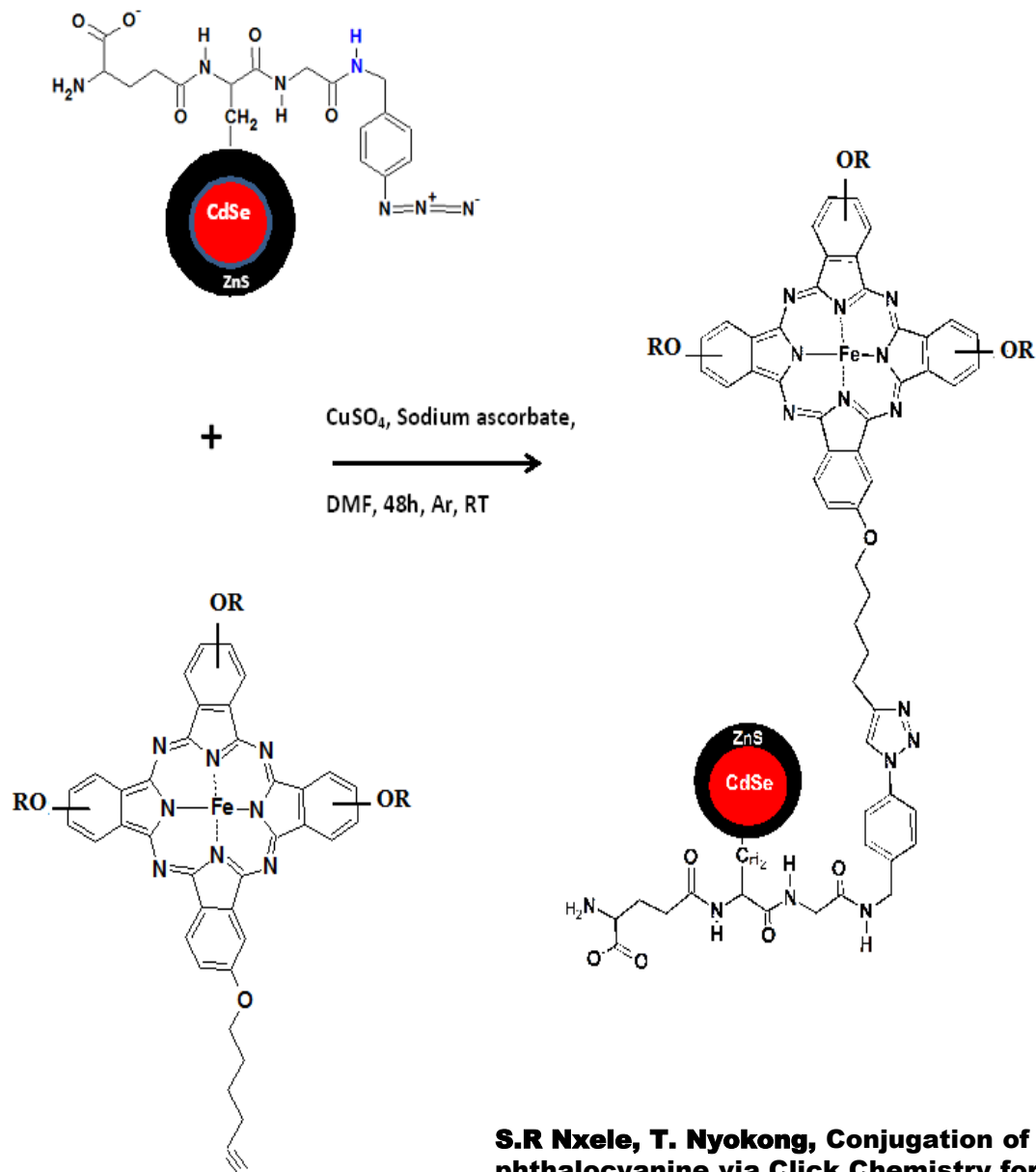
$$R_{\text{NH/COOH}} = 0.04$$

Physical characterisation: XPS N1s/C1s high resolution scans & $R_{\text{NH}/\text{COOH}}$ values

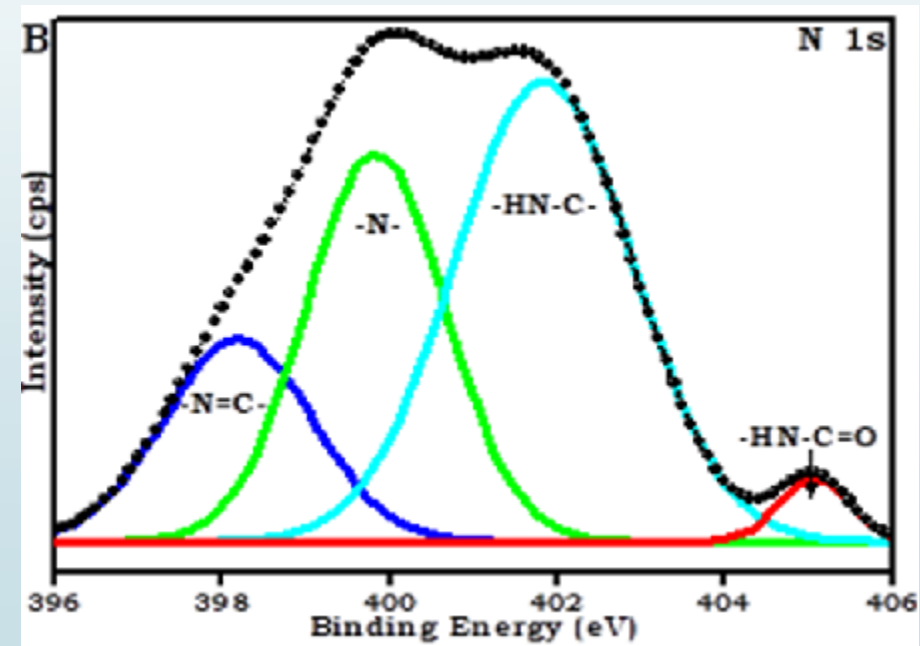
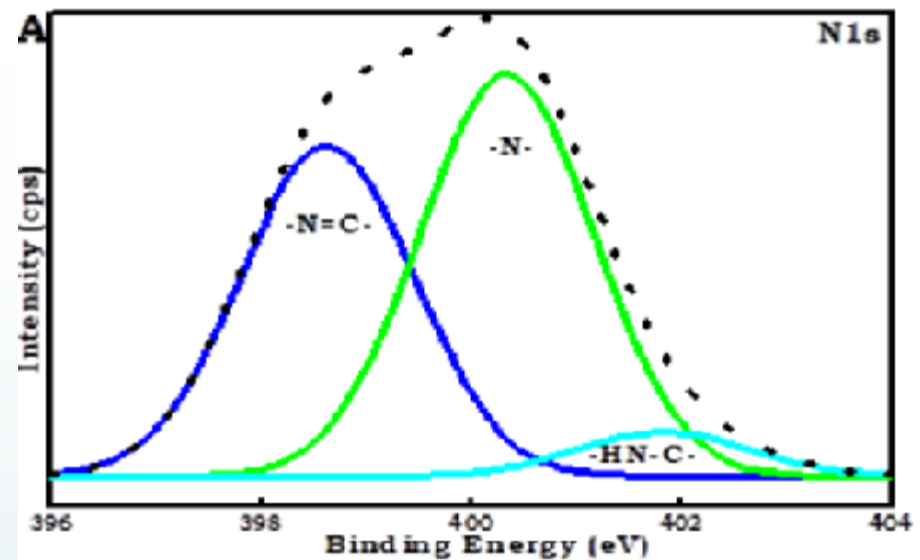
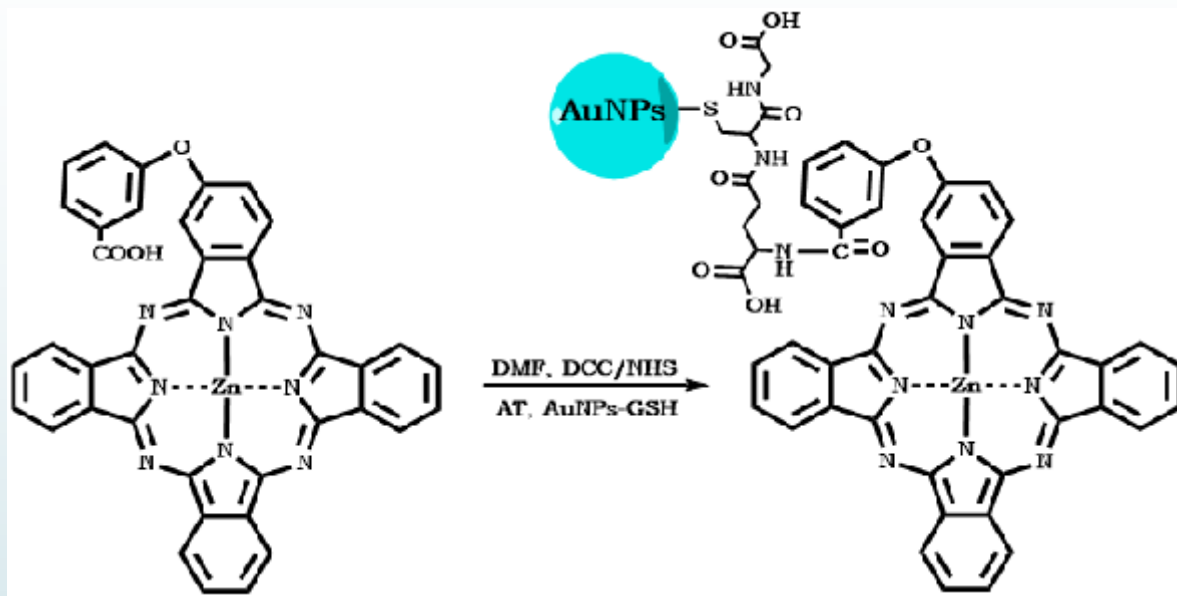


Element	Binding energy (eV)	Peak assignment
C1s	288.6	COOH
	287.2	C=O
	285.8	C-O
	284.7	C=N
	283.4	C-C
N1s	402.4	N-C=O
	401.1	N-H
	399.2	N=C
	398.4	C-N-C

$$R_{\text{NH}/\text{COOH}} = 0.45$$



S.R Nxele, T. Nyokong, Conjugation of Azide-functionalised CdSe/ZnS Quantum Dots with Tetrakis(5-hexynoxy) Fe(II) phthalocyanine via Click Chemistry for Electrocatalysis, Electrochim. Acta 194 (2016) 26-39.



David O. Oluwole^{a*}, Sello L. Manoto^b, Patience Mthunzi-Kufa^b and Tebello Nyokong, Evaluation of the Photophysical Properties and Photodynamic Therapy of Zinc Phthalocyanine-Metallic Nanoparticles Conjugates

Final remarks

- XPS is one of the best techniques to characterize molecules and determine their elemental composition
- It also is good for determining bonds formed between molecules
- It is also a useful technique as it gives quantitative data or information



Thank

you

