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## Nickel-Modified Carbon Nitride for Enhanced Photocatalysis

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## INTRODUCTION & AIM

The global rise in clean and sustainable energy has increased the importance of solar energy. Photocatalytic water splitting provides a promising approach for hydrogen production through artificial photosynthesis. Still, the low efficiency of available photocatalysts limits large-scale applications, making it necessary to create new materials with higher efficiency and better stability.

Polymeric carbon nitride (pCN) is an organic semiconductor with a graphite-like structure that has gained wide research interest in recent years because of its broad photocatalytic applications. Its advantages, including simple synthesis, tunable properties, low cost, and high chemical stability, make it a highly promising photocatalyst. However, pure pCN also has several limitations, such as a relatively high rate of electron-hole pair recombination, which limits its energy efficiency for practical applications.

This work focuses on the deposition of Ni cocatalysts using magnetron sputtering and their effect on the efficiency of pCN-Ni for hydrogen production reaction.

## METHODS

**Synthesis of pCN-Ni is complete in two steps:**

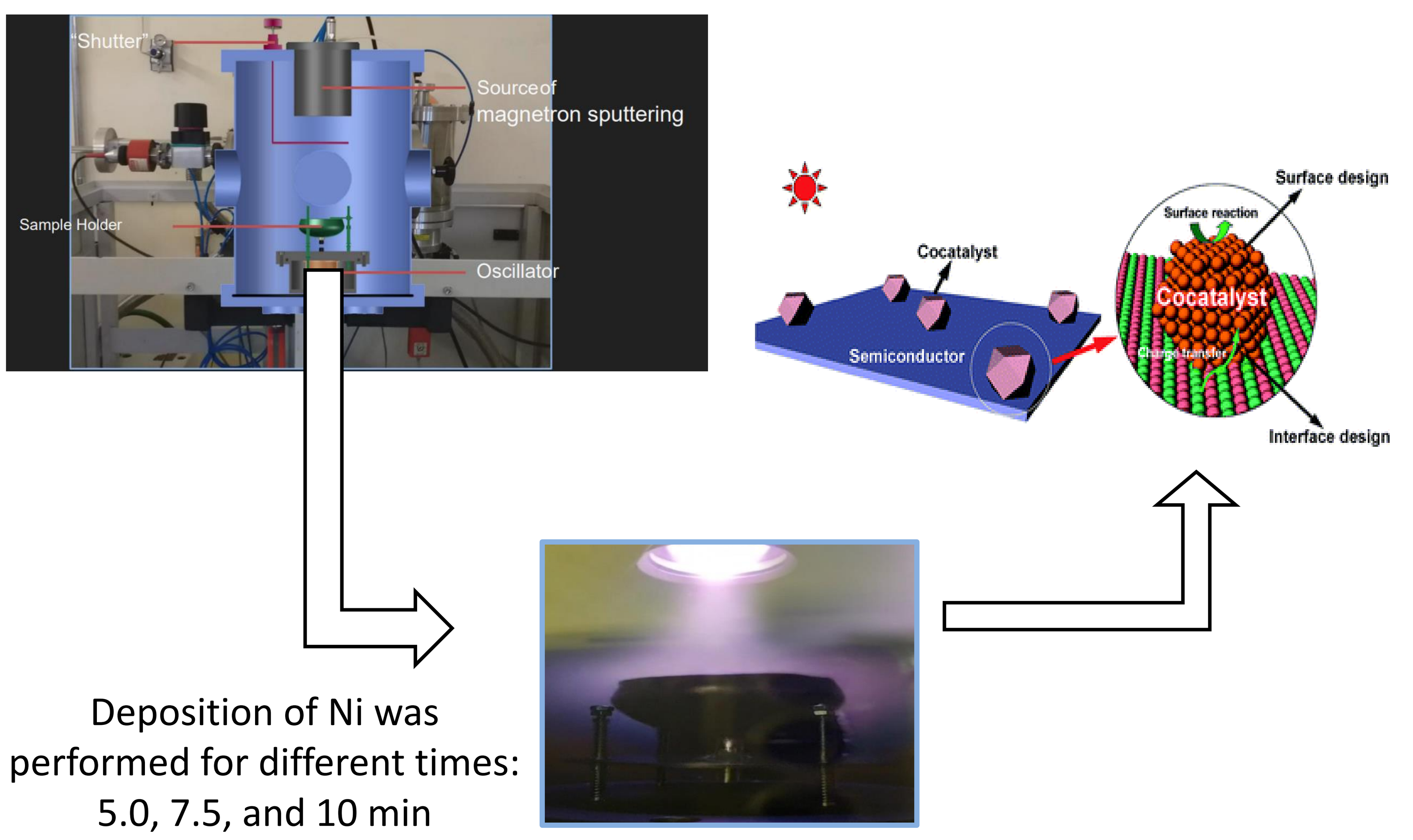
Step 1: Synthesis of pCN


Melamine

Muffle Furnace

pCN

Step 2: Deposition of Ni on pCN (pCN-Ni)




Deposition of Ni was performed for different times: 5.0, 7.5, and 10 min

## RESULTS & DISCUSSION

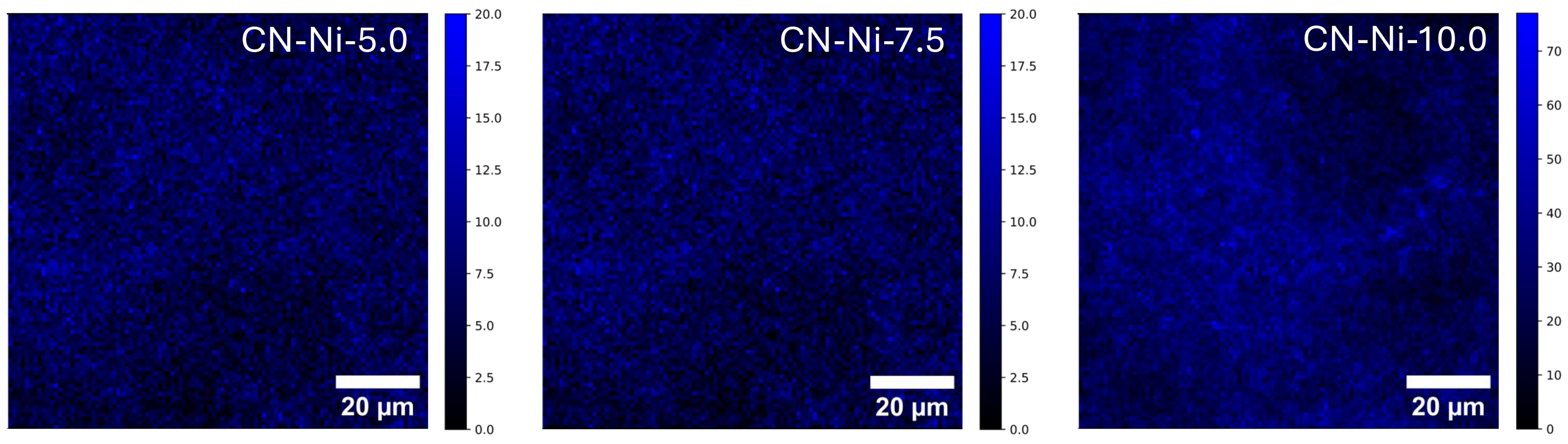



**Figure 1 -** Elemental distribution of Ni over pCN by nano-XRF.

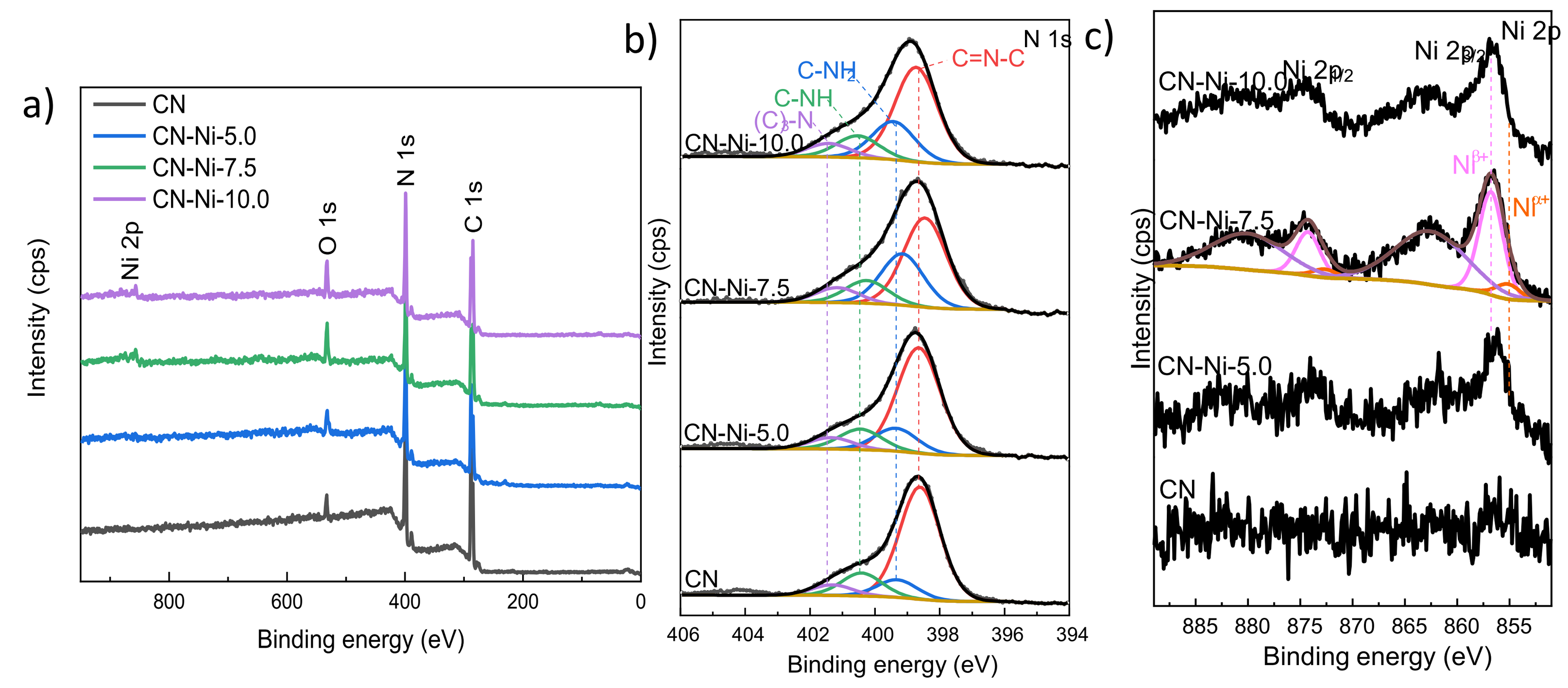



**Figure 2 –** a) Survey XPS spectra for CN-based samples b) XPS Spectra of N1s c) XPS Spectra of Ni 2p core level of CN-based Samples.

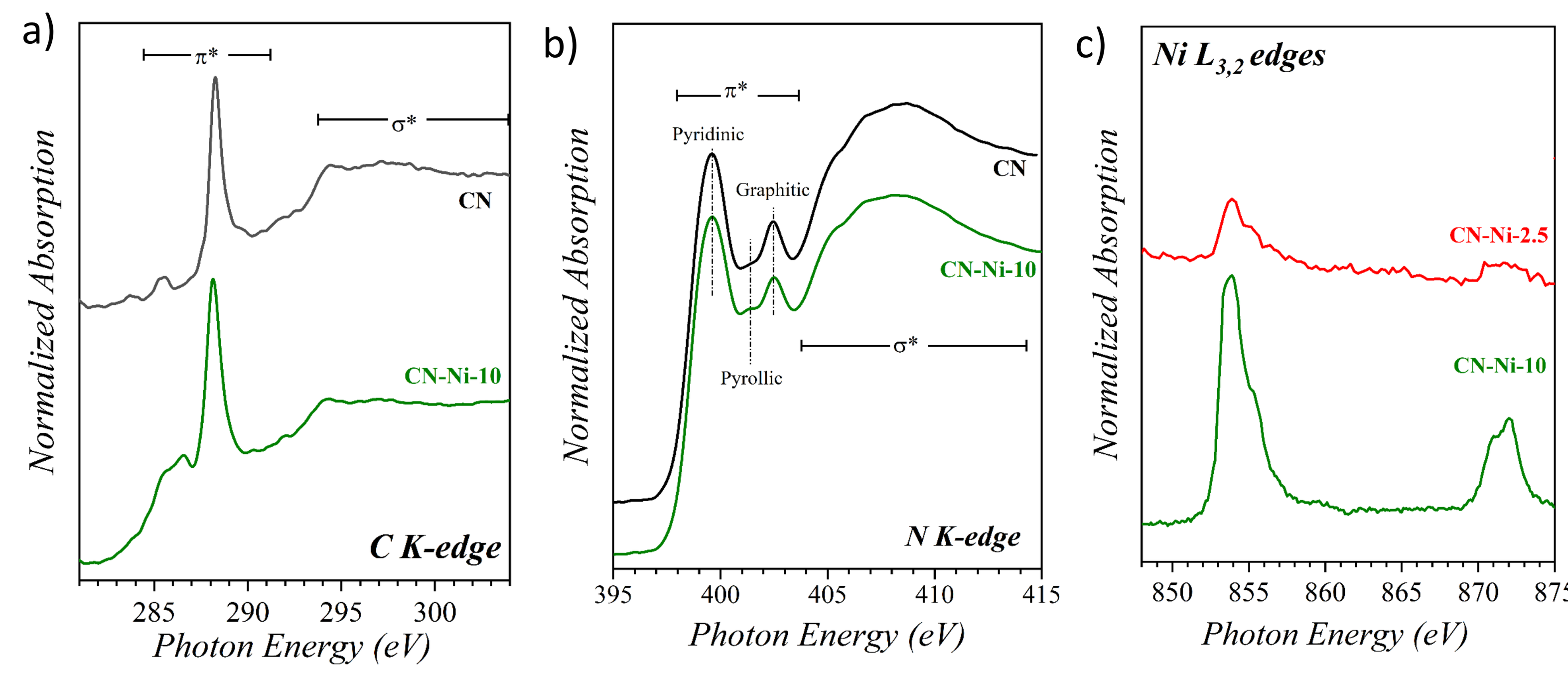



**Figure 3 –** Normalized XAS of (a) C K-edge, (b) N K-edge, and (c) Ni $L_{2,3}$ edges of the samples.

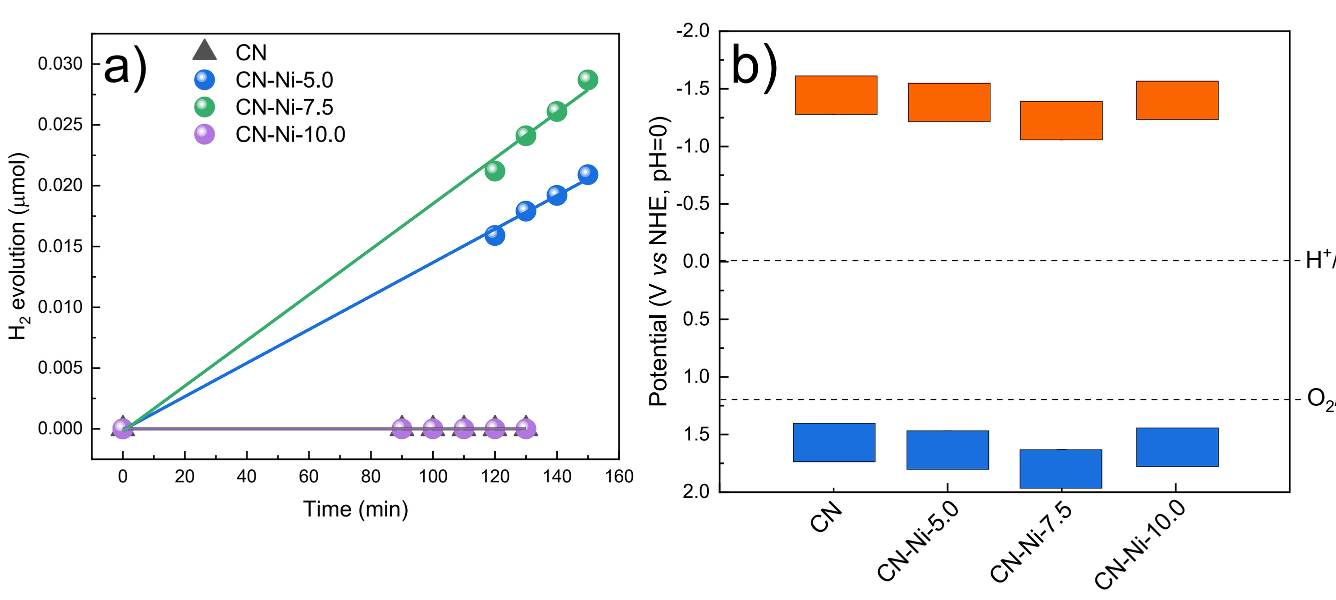



**Figure 4 –** (a) Photocatalytic $H_2$ production and (b) Energy level diagram of CN-based samples.

## CONCLUSION

The study confirms that Ni alters the chemical environment of CN within the CN structure. Ni is present in the sample as NiO and $Ni(OH)_2$, acting as an effective cocatalyst. It enhances charge separation and reduces recombination, successfully increasing the photocatalytic $H_2$ production.

## REFERENCES

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