

Supplementary Material:

Insights into the understanding of **the nickel-based pre-catalyst effect on urea oxidation reaction activity**

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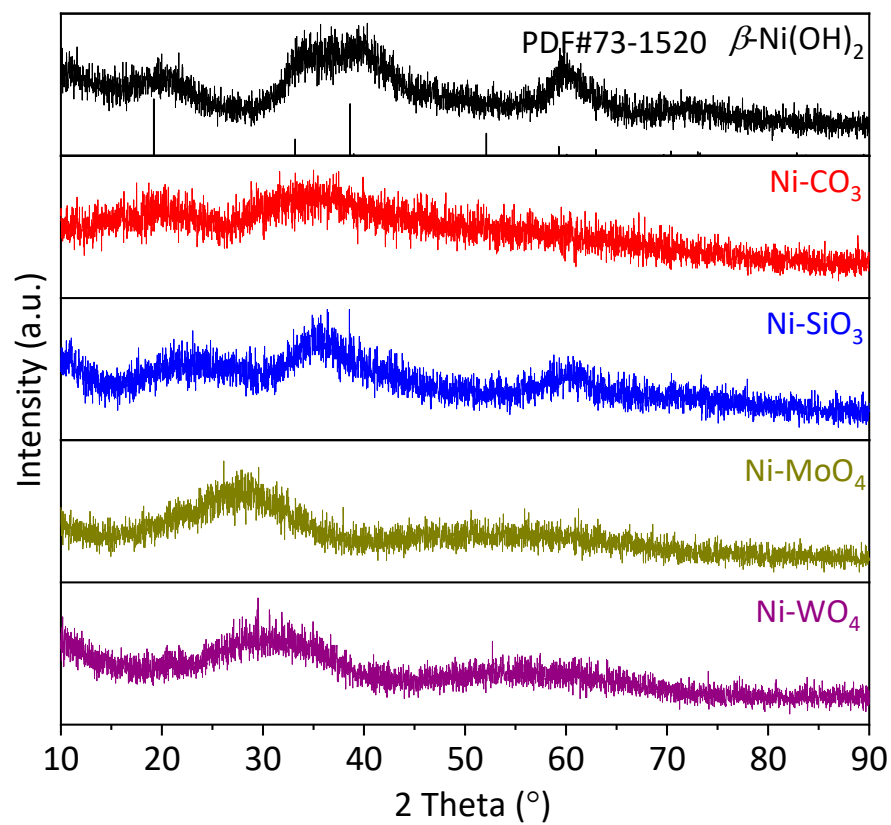


Figure S1 XRD patterns of $\beta\text{-Ni(OH)}_2$, Ni-CO_3 , Ni-SiO_3 , Ni-MoO_4 and Ni-WO_4 .

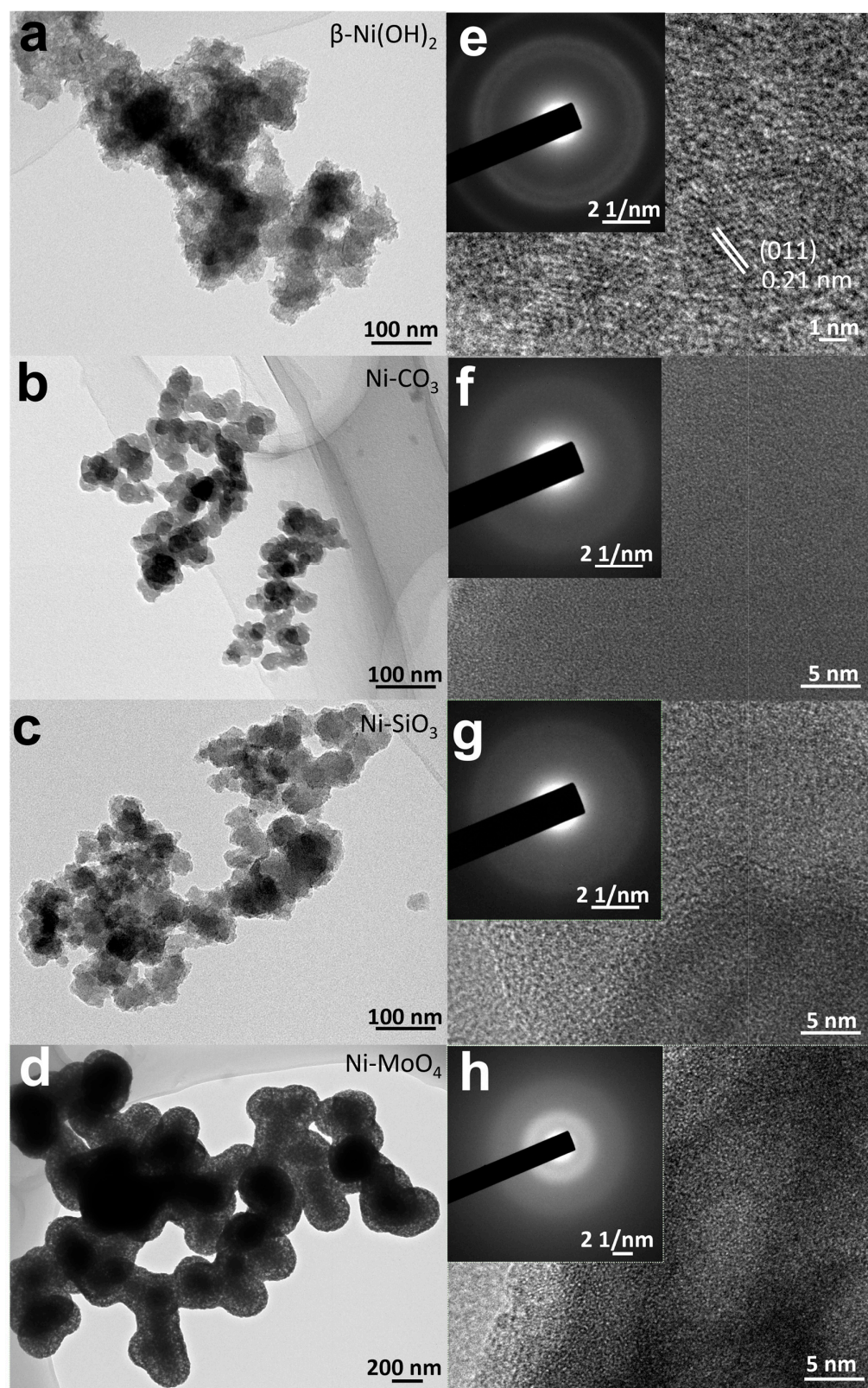


Figure S2 (a-d) TEM images of $\beta\text{-Ni(OH)}_2$, Ni-CO_3 , Ni-SiO_3 and Ni-MoO_4 . **(e-h)** HRTEM images of $\beta\text{-Ni(OH)}_2$, Ni-CO_3 , Ni-SiO_3 and Ni-MoO_4 , insets are the corresponding SAED patterns.

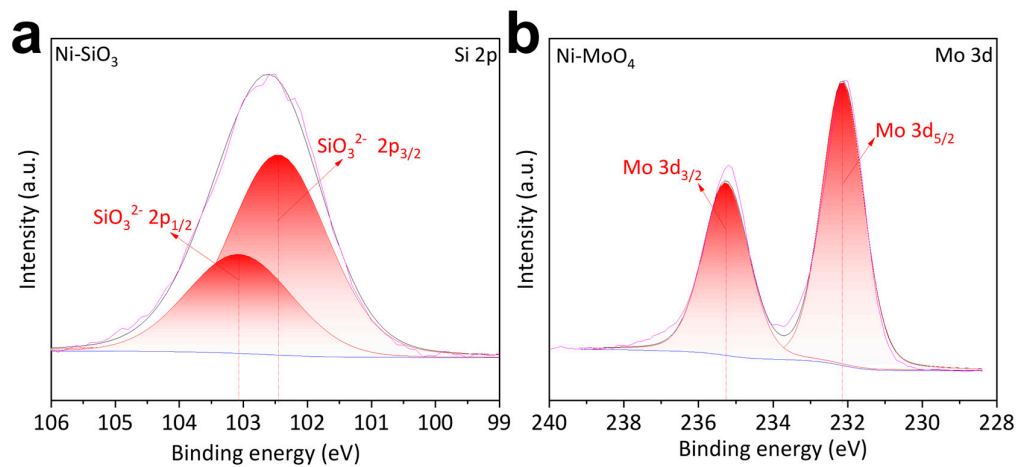


Figure S3 (a) Si 2p XPS of Ni-SiO₃. (b) Mo 3d XPS of Ni-MoO₄.

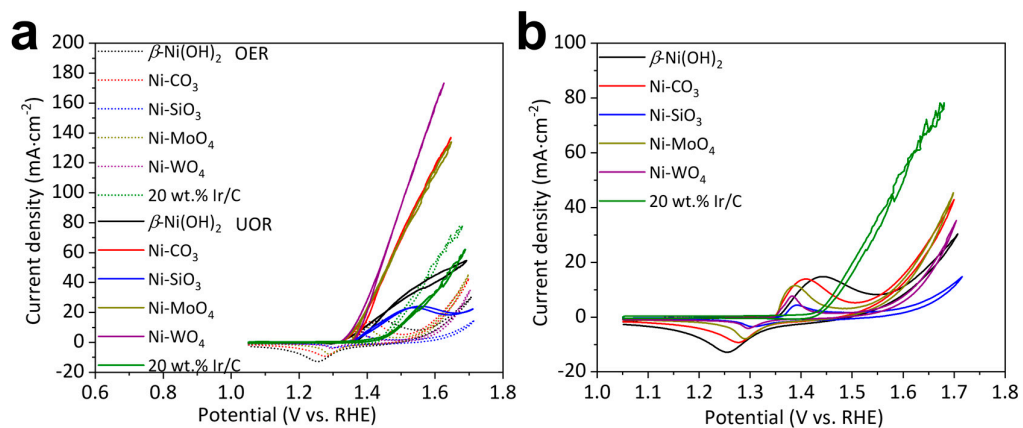


Figure S4 (a) OER and UOR CV curves of β -Ni(OH)₂, Ni-CO₃, Ni-SiO₃, Ni-MoO₄, Ni-WO₄ and 20 wt.% Ir/C. **(b)** OER CV curves of β -Ni(OH)₂, Ni-CO₃, Ni-SiO₃, Ni-MoO₄, Ni-WO₄ and 20 wt.% Ir/C.

Table S1 C 1s and W 4f XPS fitting results of Ni-CO₃ and Ni-WO₄

		Ni-CO ₃	Ni-CO ₃ - durability	Ni-WO ₄	Ni-WO ₄ - durability
W4f	WO ⁴⁺ 4f _{7/2}	—	—	34.98	—
	WO ⁴⁺ 4f _{5/2}	—	—	37.16	—
	Loss feature	—	—	40.81	—
C1s	Carbon C-C	284.60	284.60	—	—
	Carbon C-O	268.14	268.14	—	—
	Carbon C=O	287.60	287.60	—	—
	Carbon C-F	—	288.77	—	—
	CO ₃ ²⁻ C-O	289.29	—	—	—
	CO ₃ ²⁻ C=O	291.46	—	—	—
	-CF ₂ -CF ₂ -/-SCF ₂ -C-	—	292.19	—	—
	-OCF ₂ -C-	—	293.88	—	—
	-CF ₃ -C-	—	296.89	—	—