

Supplementary Materials

Phase Transformations in the Nickel Phosphide System Induced by Doping and their Electro-catalytic Study.

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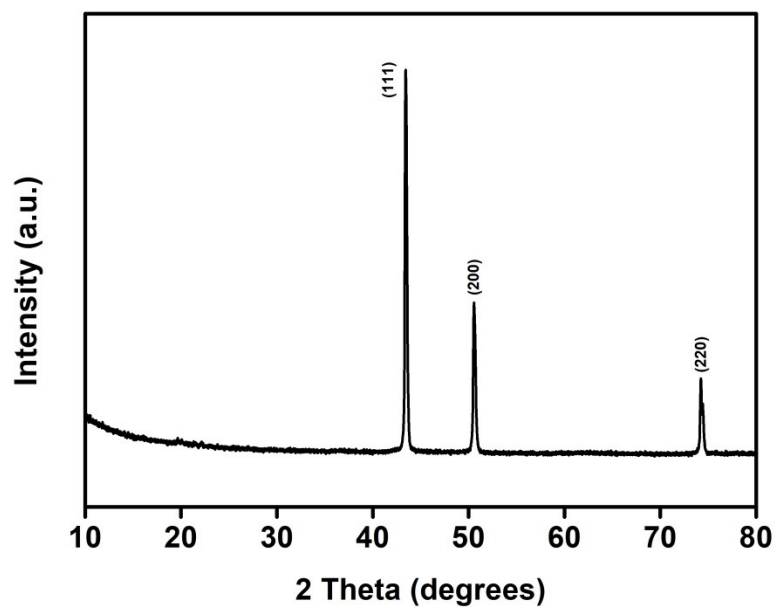


Figure S1. Powder XRD patterns of the decomposition of $\text{Cu}(\text{Ac})_2 \cdot \text{H}_2\text{O}$ in TOPO/TOP or HDA/TOP or TOP only at 300 °C for 1 hr (ICDD# 01-089-2838).

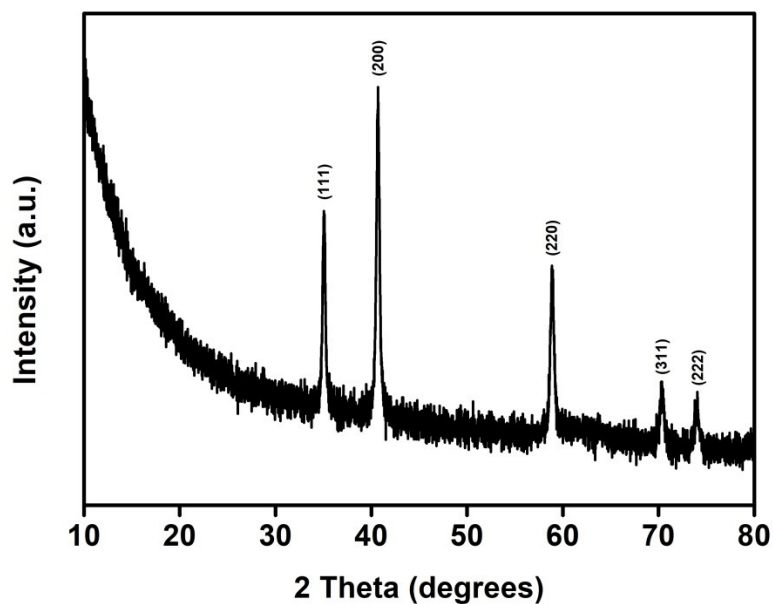


Figure S2. Powder XRD patterns of the decomposition of $\text{Mn}(\text{Ac})_2$ in TOPO/TOP or HDA/TOP or TOP only at 300 °C for 1 hr (ICDD# 01-075-6626).

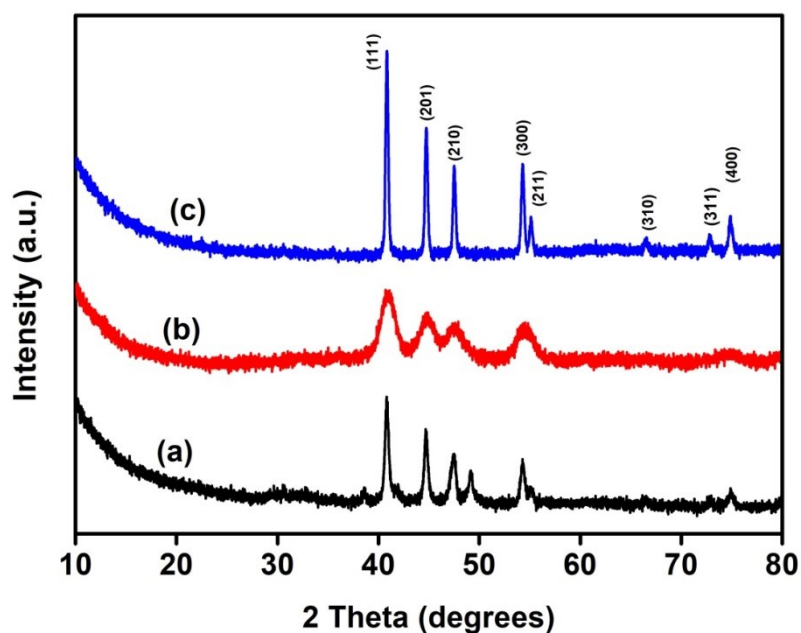


Figure S3. Powder XRD patterns of the decomposition of (a) nickel acetate tetrahydrate $[\text{Ni}(\text{Ac})_2 \cdot 4\text{H}_2\text{O}]$ (b) $\text{Ni}(\text{Ac})_2 \cdot 4\text{H}_2\text{O}/10\% \text{ Cu}(\text{Ac})_2 \cdot \text{H}_2\text{O}$ and (c) $\text{Ni}(\text{Ac})_2 \cdot 4\text{H}_2\text{O}/10\% \text{ Mn}(\text{Ac})_2$ all in TOP only at 300 °C for 1 hr.

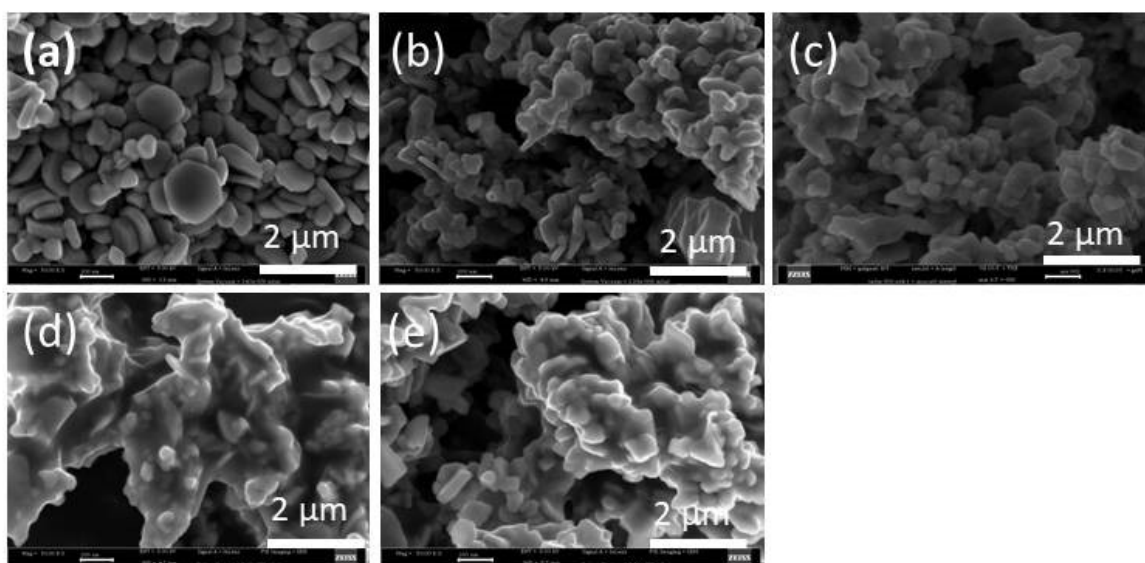


Figure S4. SEM images of (a) NiP-1 (b) 5% Mn doped NiP-1 (c) NiP-4 (d) 5% Cu doped NiP-1 and (e) NiP-3.

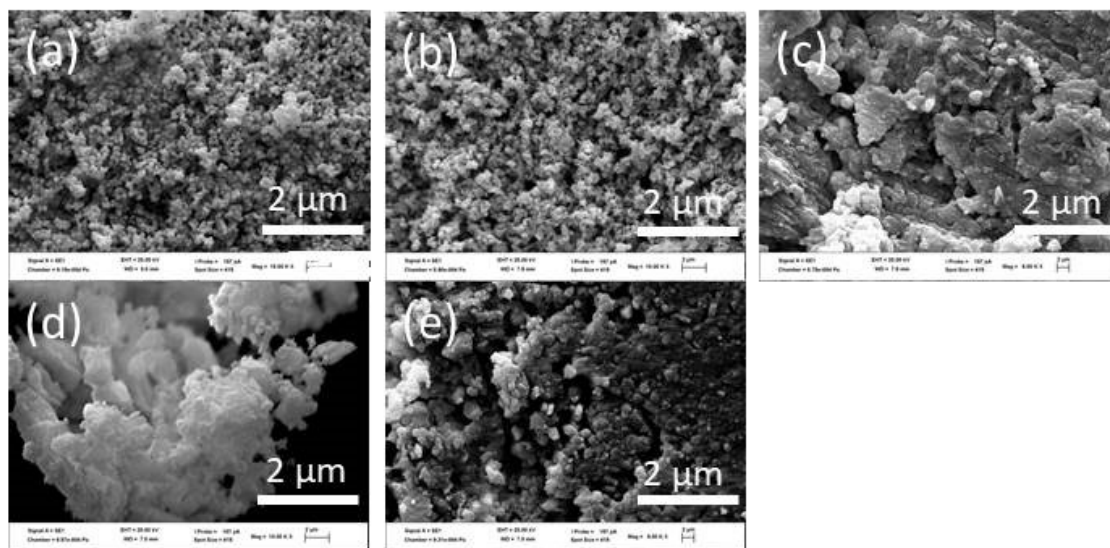


Figure S5. SEM images of (a) NiP-2 (b) 5% Mn doped NiP-2 (c) NiP-6 (d) 5% Cu doped NiP-2 and (e) NiP-5.

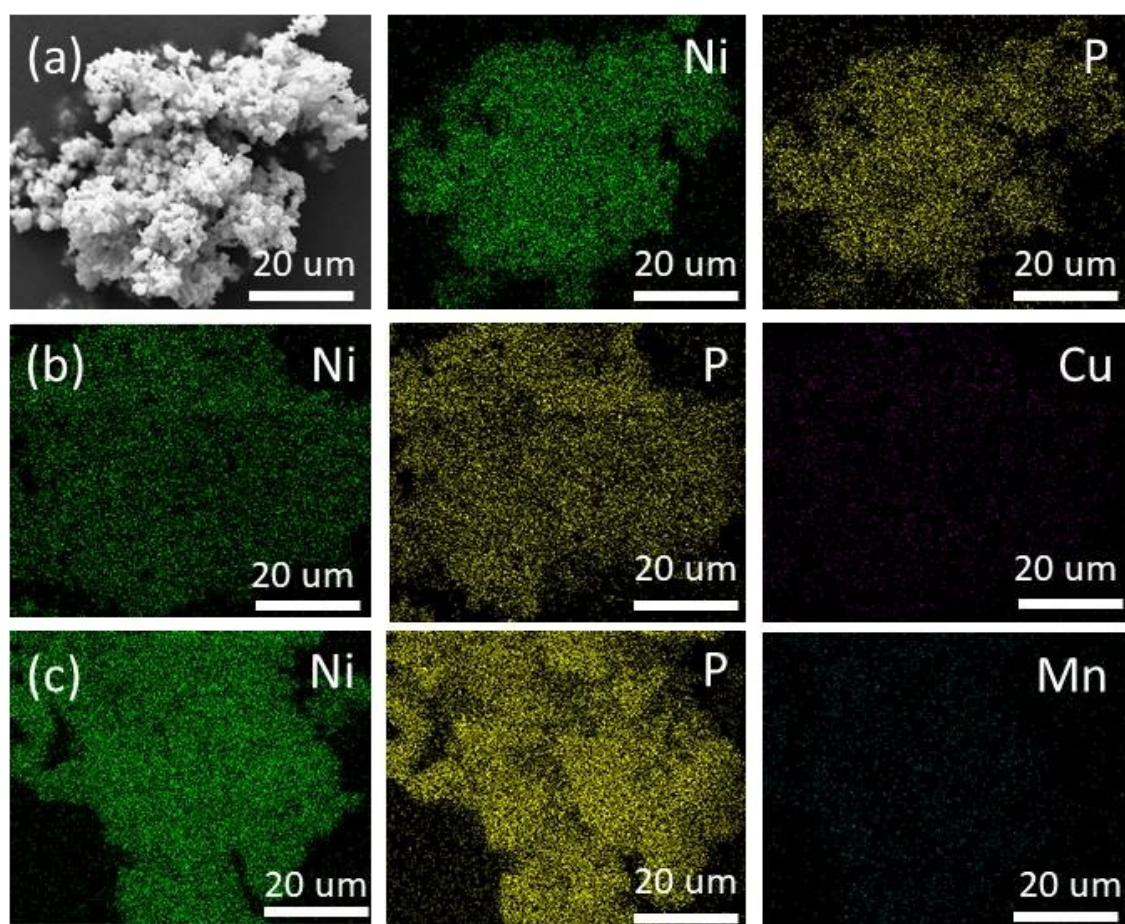


Figure S6. SEM-EDX elemental mapping of (a) NiP-1 (b) NiP-3 and (c) NiP-4.

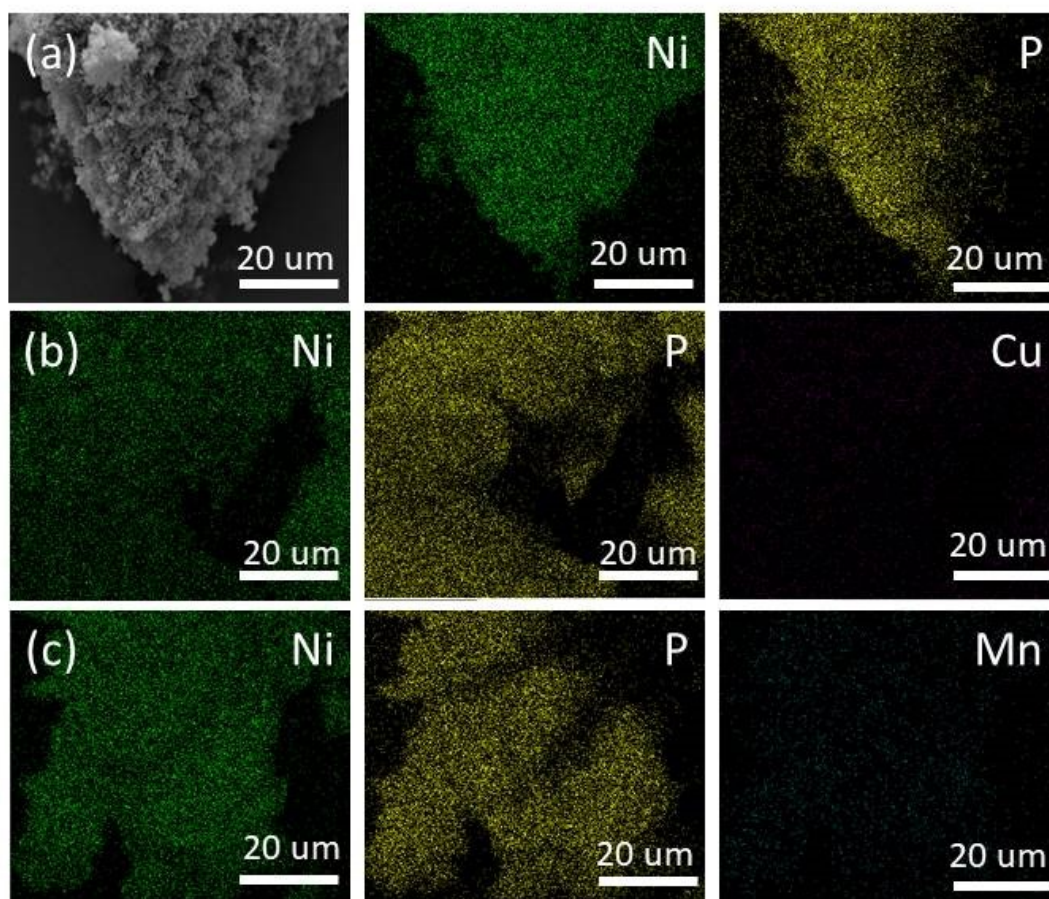


Figure S7. SEM-EDX elemental mapping of (a) NiP-2 (b) NiP-5 and (c) NiP-6.

Table S1. Comparison of NiP-2 and NiP-3 electrodes' storage capacity and energy density to other reported similar electrodes.

Electrode	Specific capacity	Energy density (Wh/Kg)	Reference
Ni ₂ P/Ni	464 F/g at 40 A/g	70.2	1
Co-Ni ₂ P	864 F/g at 1 A/g	-	2
Fe-Ni ₂ P	856 F/g at 1 A/g	-	2
Ni ₂ P	674 F/g at 1 A/g	-	2
Ni ₅ P ₄ -Ni ₂ P (Ni _x P _y)	1272 C/g at 2 A/g	20.4	3
Ni ₂ P at NF	491.9 mAh/g at a scan rate of 5 mV/s	108.1	4
Ni-Co-P/PO _x /C	583 C/g at 1 A/g	37.59	5
NiCo ₂ (P) _x	1280 C/g at 1 A/g	41.9	6
(Ni ₃ (PO ₄) ₂ ·8H ₂ O)-U4	1177 F/g at 0.5 A/g	38.2	7
P-NiO	631.8 C/g at 1 A/g	53.4	8
NiP-2	1325 F/g at 2 A/g	60	This study
NiP-3	1209 F/g at 1 A/g	51	This study

Table S2. Comparison of HER results of our electrodes to other similar reported electrodes.

Electrode	Overpotential (mV)	Tafel slope (mV/dec)	Reference
Ni ₂ P@glassy carbon substrate	~ 270	84	9
Ni ₁₂ P ₅ @glassy carbon substrate	~ 450	108	9
Ni ₂ P particles	310	109	10
Ni ₂ P	164	117	2
Co-Ni ₂ P	158	113	2
Fe-Ni ₂ P	202	113	2
Ni ₂ P	174	115	11
Ni ₁₂ P ₅	~ 670	270	12
Ni ₂ P	270	86	13
NiP-5	146	116	This study
NiP-4	162	109	This study
NiP-6	164	133	This study
NiP-2	167	114	This study
NiP-1	186	109	This study
NiP-3	203	145	This study

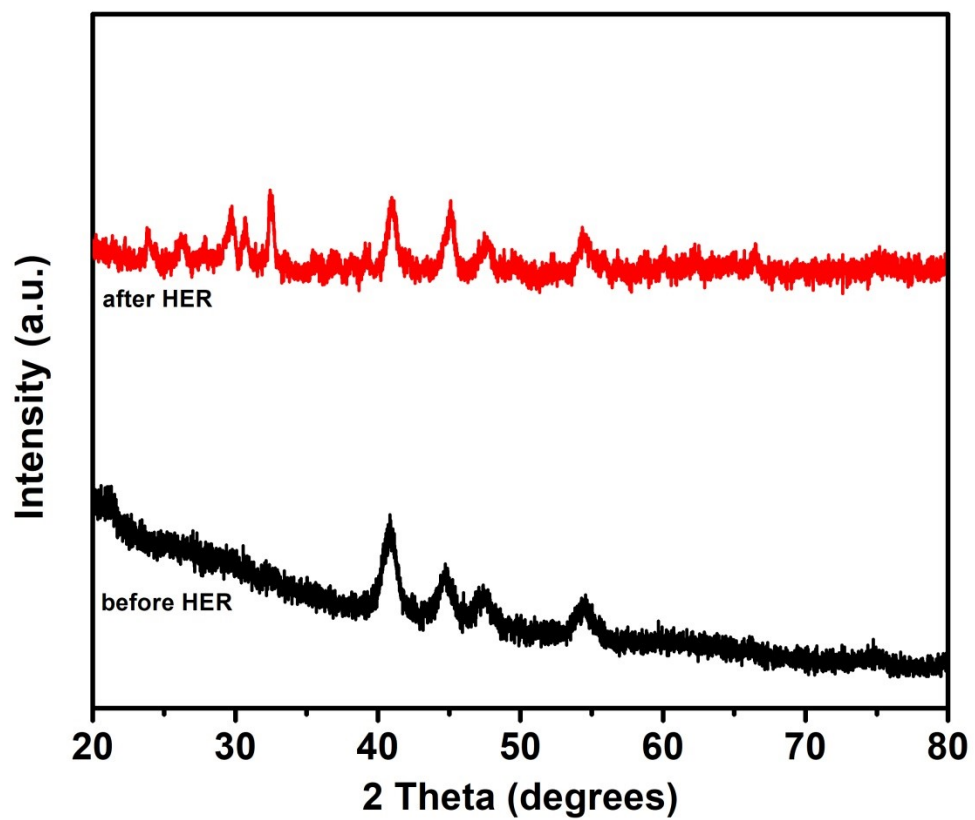


Figure S8. XRD patterns of NiP-6 before and after HER.

Table S3. Comparison of OER results of our electrodes to other similar reported electrodes.

Electrode	Overpotential (mV)	Tafel slope (mV/dec)	Reference
Ni ₂ P	~ 500	70	14
Ni ₂ P-CoP	320	69	15
Ni-P nanoplates	300	64	16
Ni ₂ P	340	103	2
Co-Ni ₂ P	320	91	2
Fe-Ni ₂ P	259	69	2
Ni ₂ P nano wire	~ 400	60	14
NiP-5	347	54	This study
NiP-4	324	83	This study
NiP-6	345	67	This study
NiP-2	324	80	This study
NiP-1	344	70	This study
NiP-3	276	85	This study

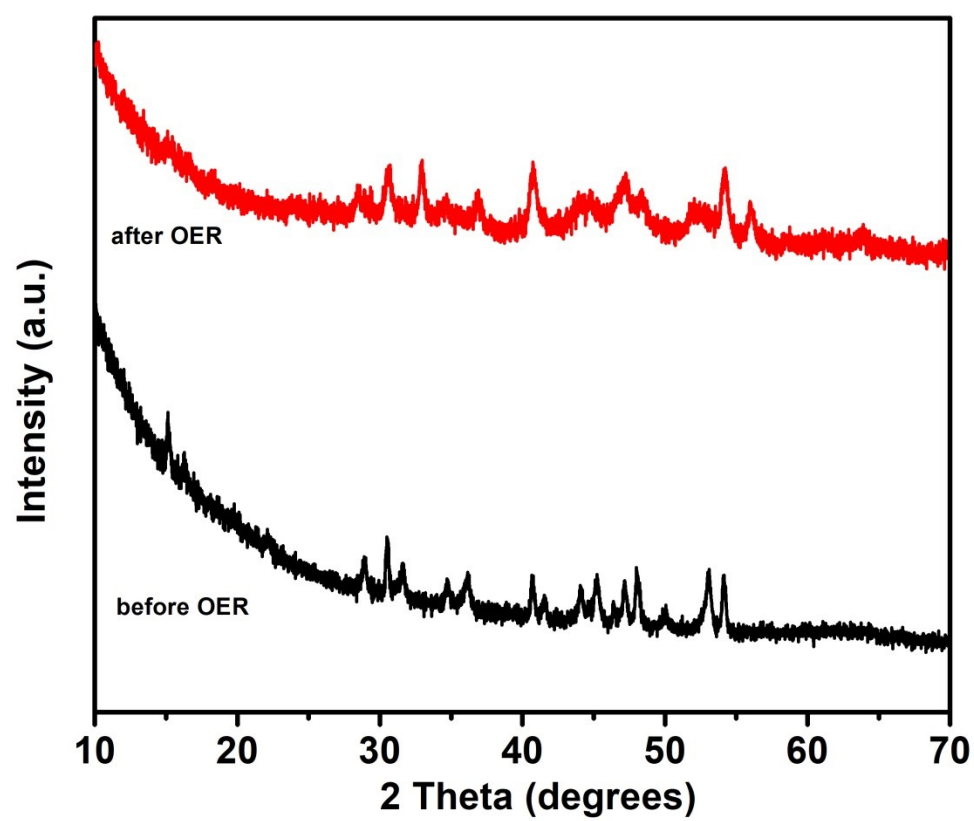


Figure S9. XRD patterns of NiP-3 before and after OER.

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