



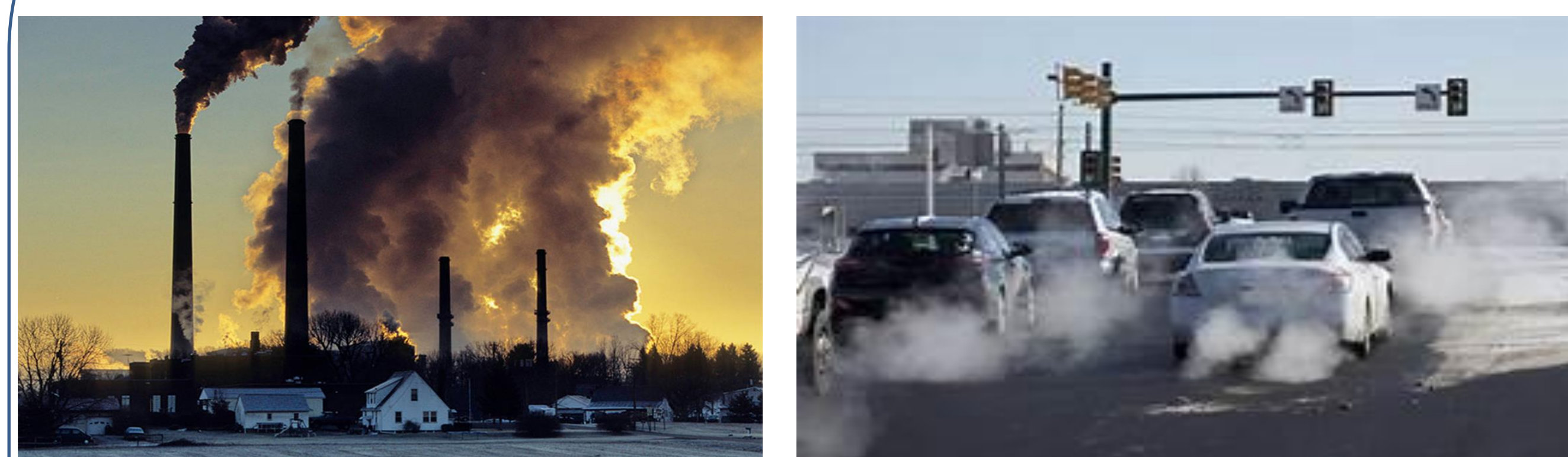
Green Preparation of Nickel Phosphides as Catalysts for Green Hydrogen Production

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Introduction



- The demand for energy on earth keep rising.
- Fossil fuels supply most of this energy.
- The use of these fuels creates environmental sustainable issues.
- Hydrogen fuel is a touted alternative source of energy today
- Water splitting that produces hydrogen is restricted by noble metal Catalyst.
- Cheap catalysts therefore desired

Precursors employed

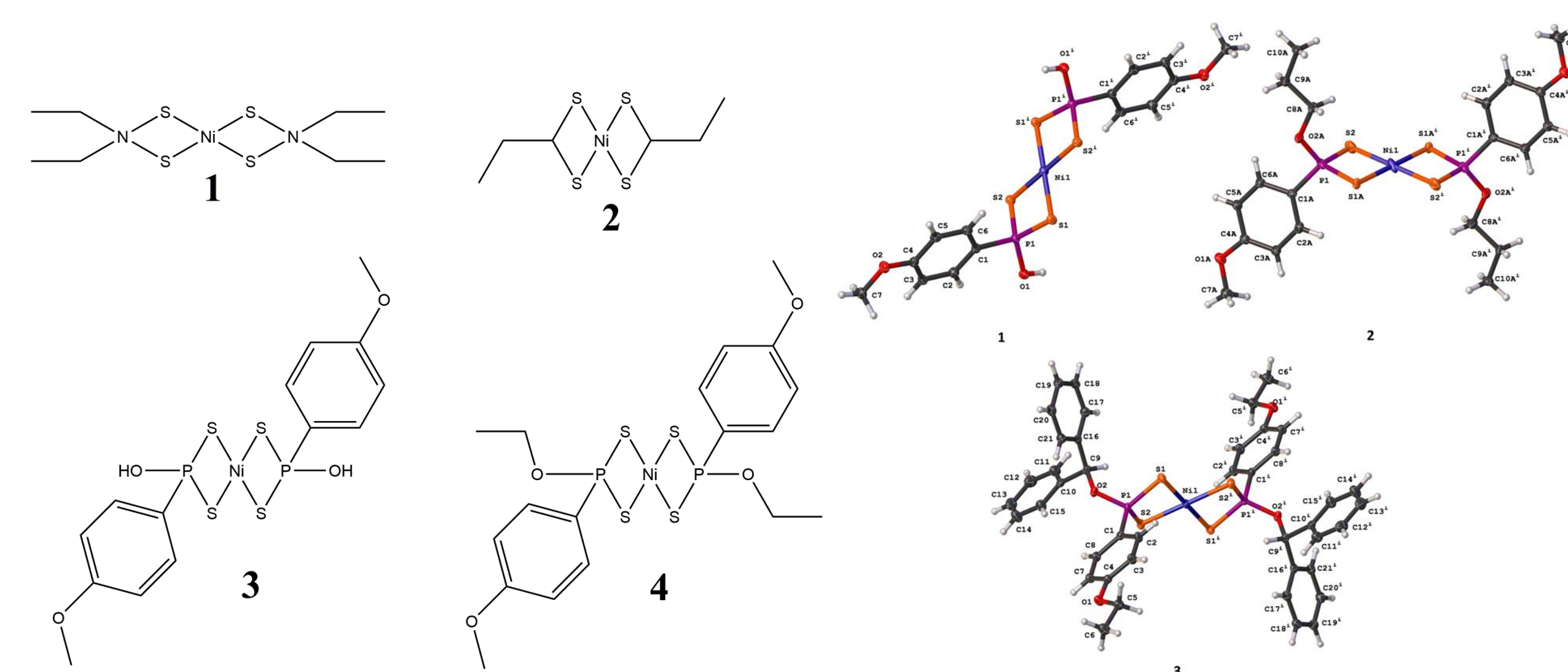


Figure 1. Molecular structures of complexes deployed

Ni₂P Preparation

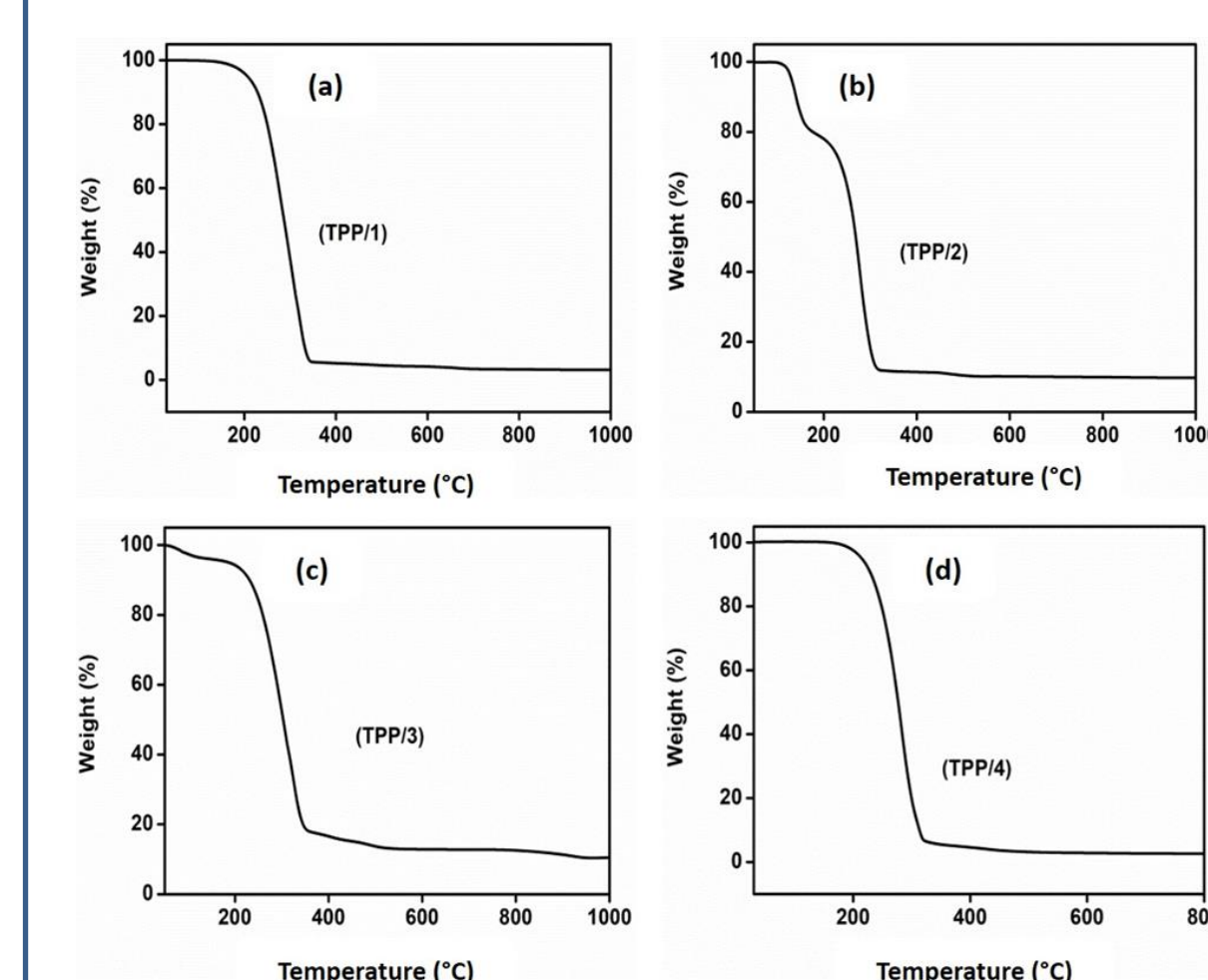
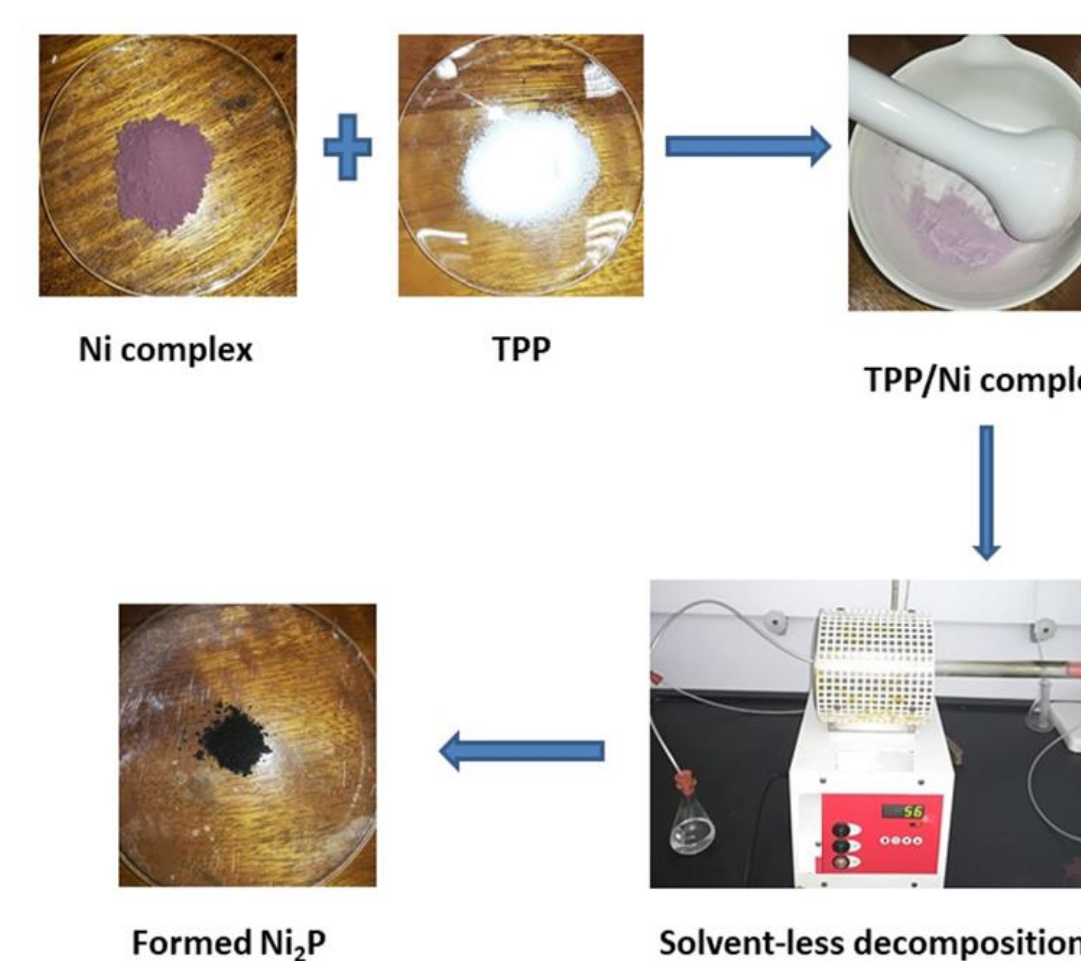


Figure 2. TGA of complexes/TPP composites



Scheme 1. Synthetic flow of Ni₂P preparation

Characterization

Table 1. Formed materials

Complex	TPP	Temperature Formed (°C)	phase
1	No	300	NiS
1	Yes	300	Ni ₃ S ₂
2	No	250	NiS
2	Yes	250	Ni ₃ S ₂
2	Yes	350	Ni ₃ S ₂
2	Yes	400	Ni ₃ S ₂
3	No	400	NiS
3	Yes	400	Ni ₂ P
4	No	400	NiS
4	Yes	400	Ni ₂ P

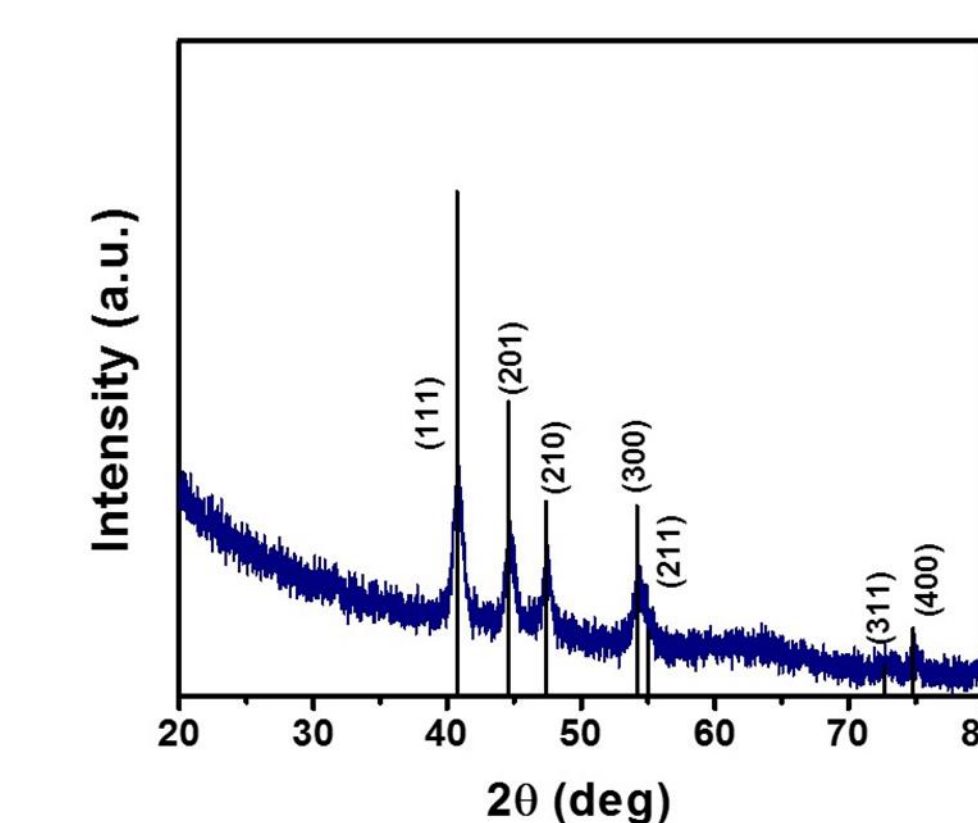


Figure 3. PXRD patterns of Ni₂P

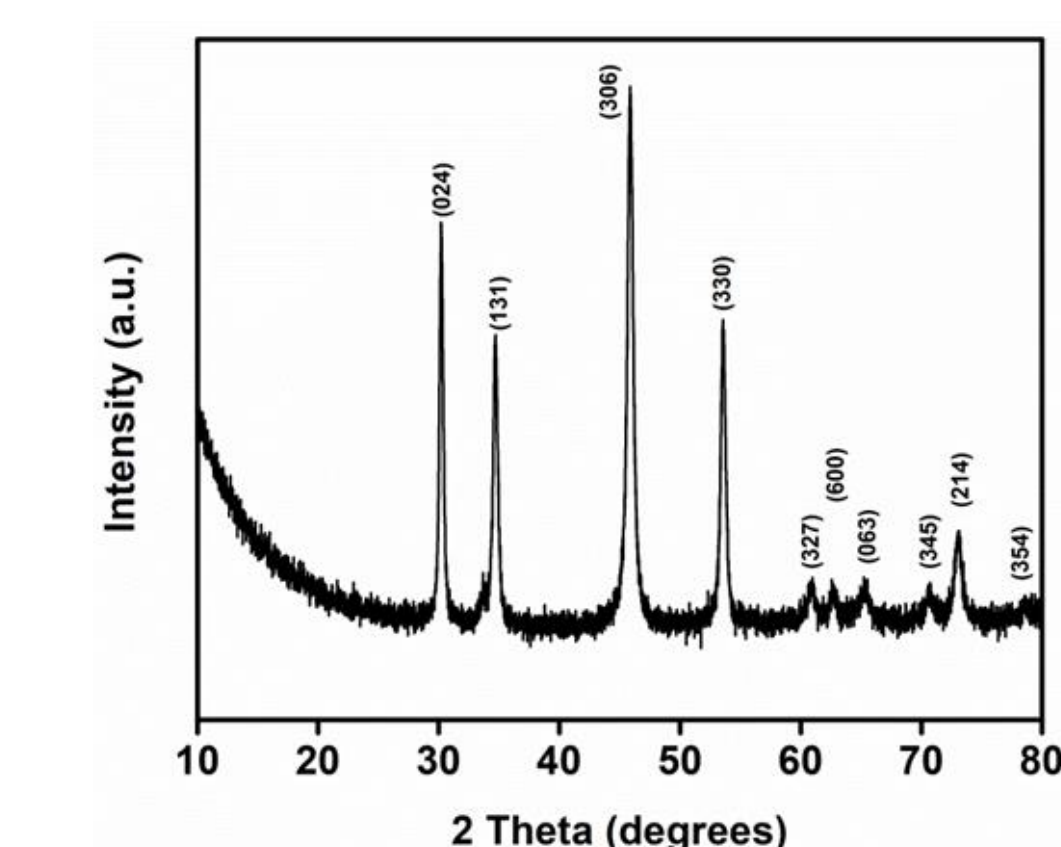


Figure 4. PXRD patterns for NiS

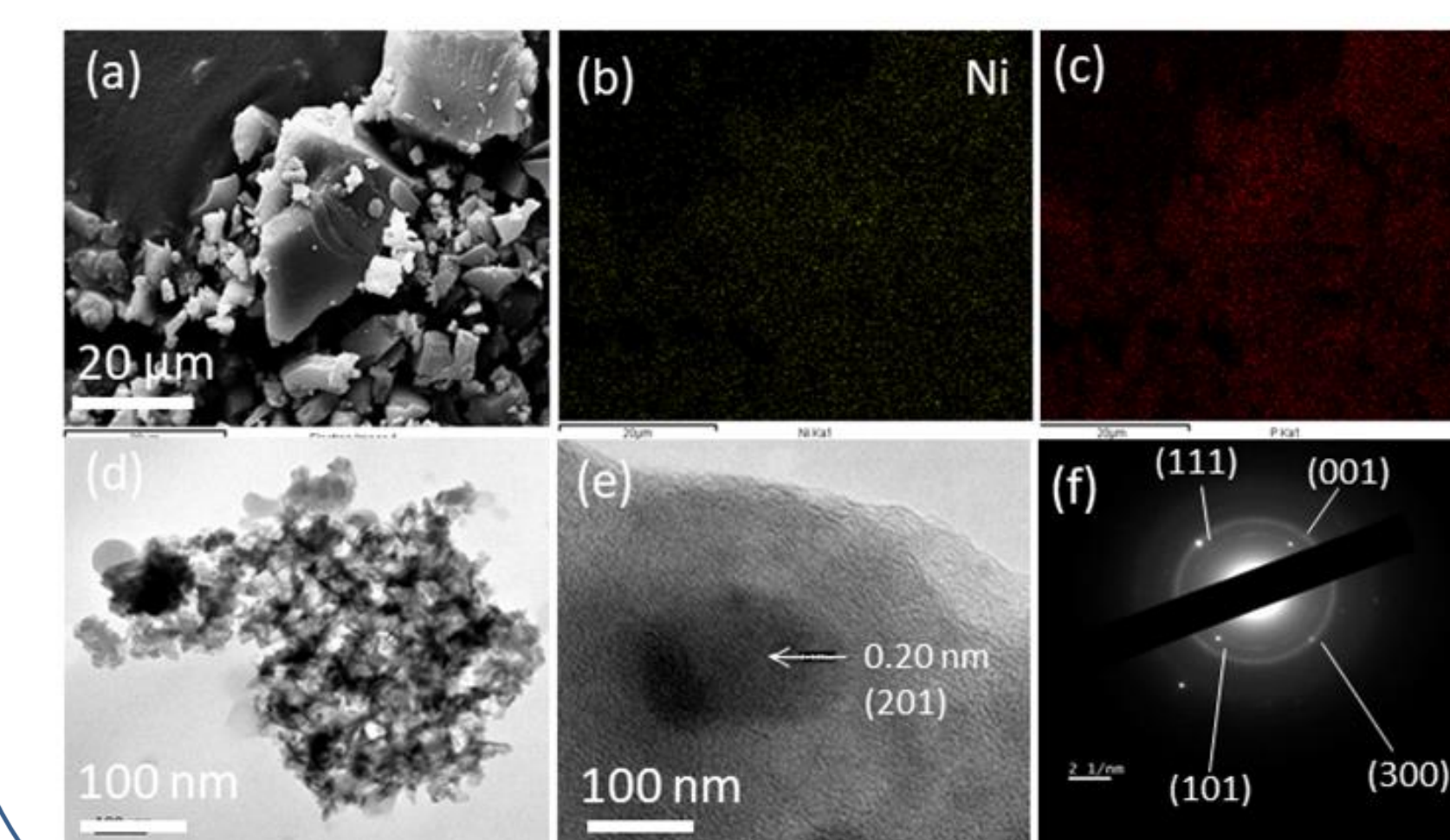


Figure 5. SEM (a), elemental distribution (b,c), TEM (d) HRTEM (e) and SAED (f) of Ni₂P

H₂ production

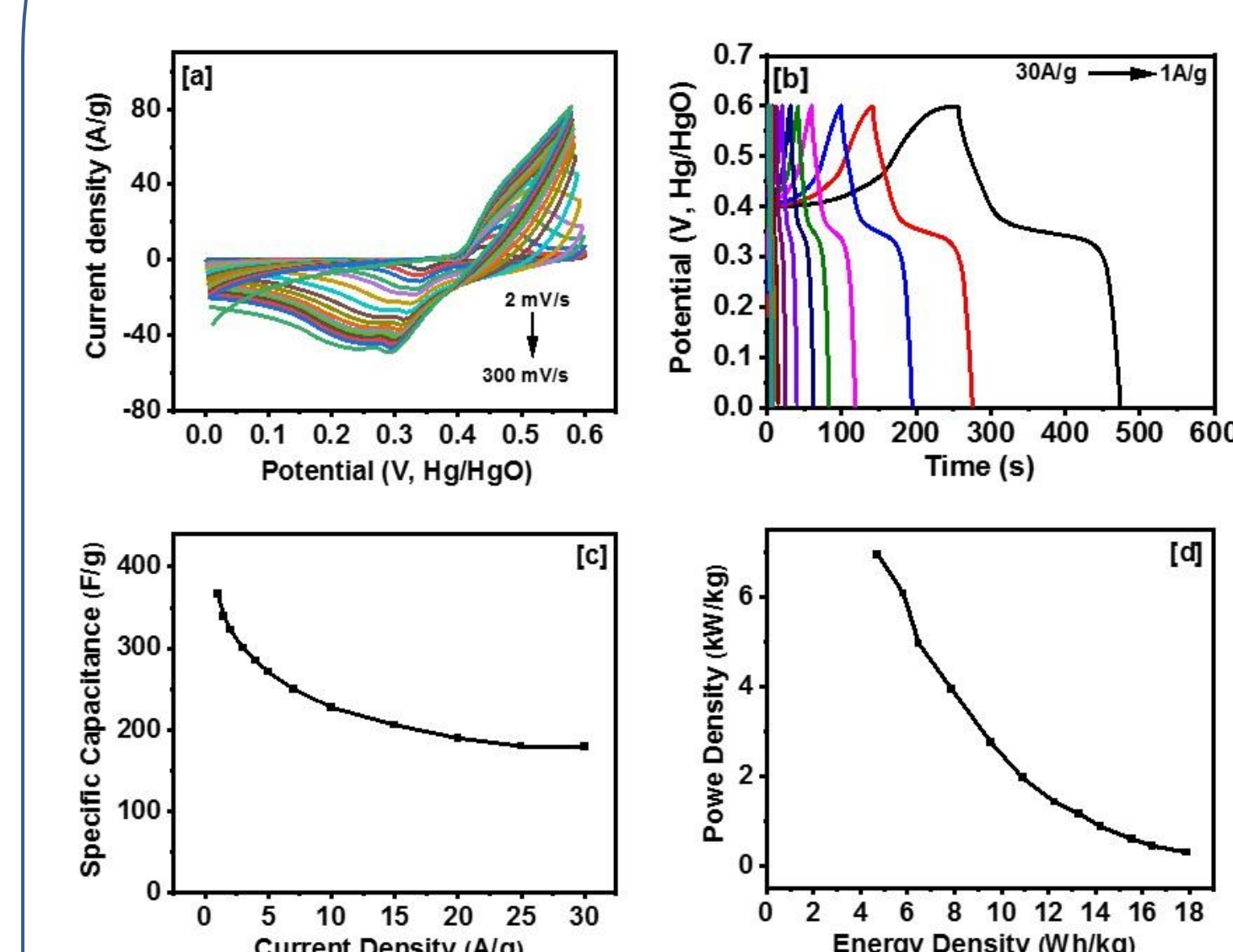


Figure 6. CV (a), charge-discharge behaviour & current (c) and energy (d) density of Ni₂P

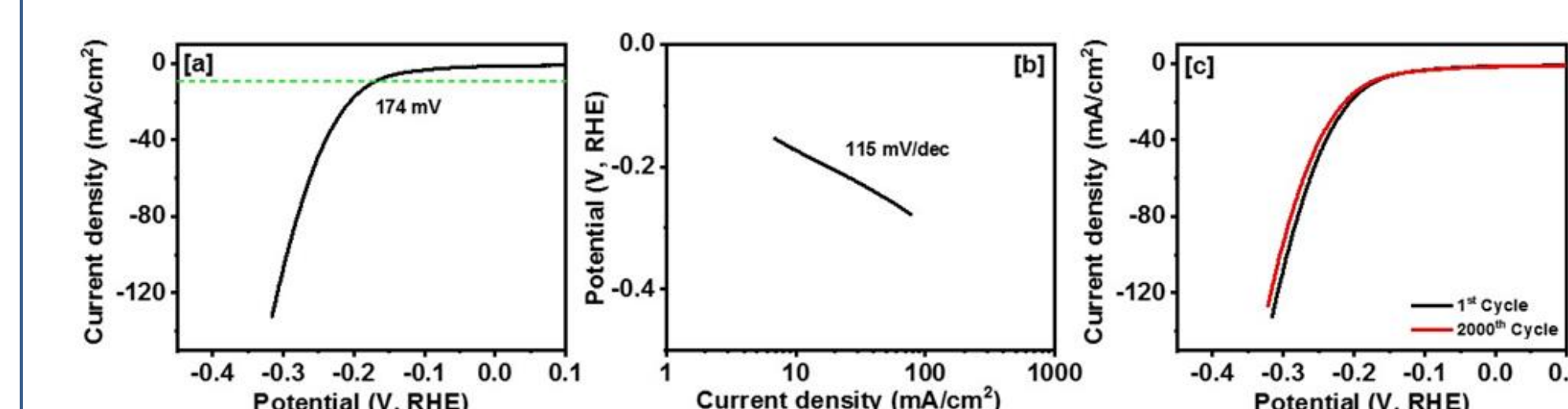


Figure 7. LSV curves for H₂ production

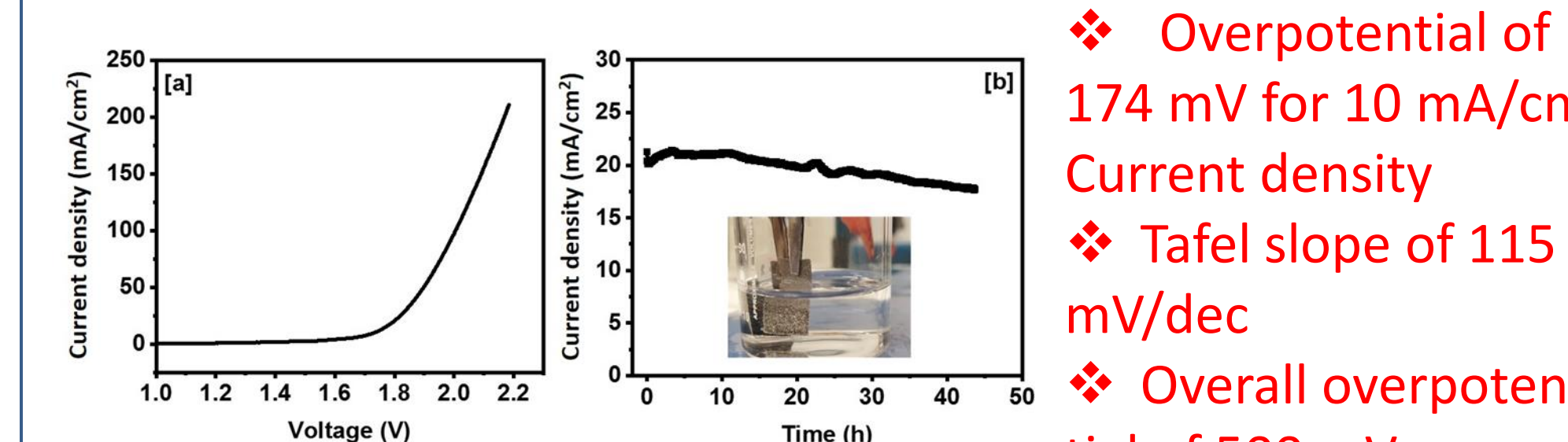


Figure 8. LSV curves for overall water splitting

❖ Specific capacitance of 367 F/g @ 1 A/g Current density

❖ Energy density of 17.9 Wh/Kg

❖ Overpotential of 174 mV for 10 mA/cm² Current density
❖ Tafel slope of 115 mV/dec
❖ Overall overpotential of 500 mV

Acknowledgement

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