

## Supporting Information

### Encapsulating Ir Nanoparticles into UiO-66 for Photo-thermal Catalytic CO<sub>2</sub>

#### Methanation under Ambient Pressure

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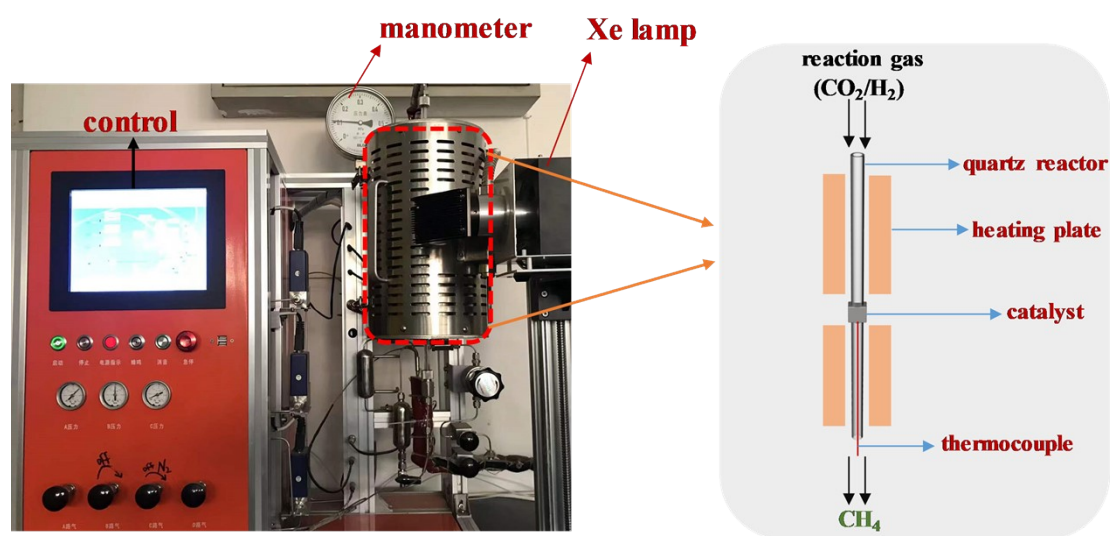
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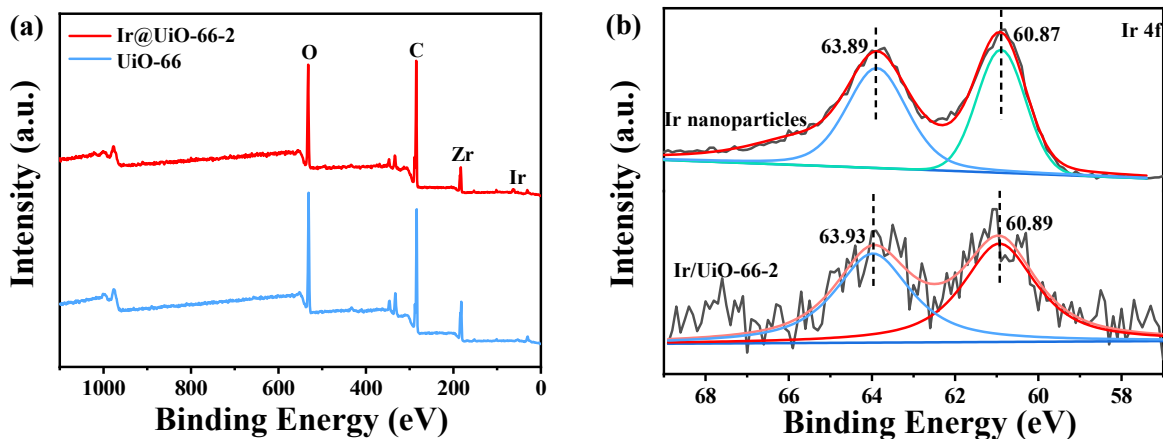
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**Table S1.** The Ir loadings in the Ir@UiO-66 catalysts confirmed by ICP-OES.

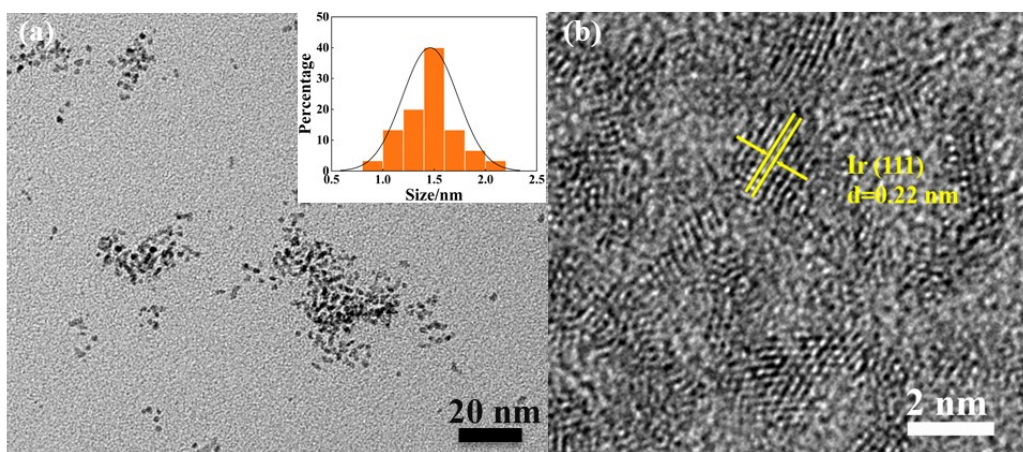
Entry	Catalyst	Ir loading (wt%)
1	Ir@UiO-66-1	0.07
2	Ir@UiO-66-2	0.14
3	Ir@UiO-66-3	0.26
4	Ir/UiO-66-2	0.11



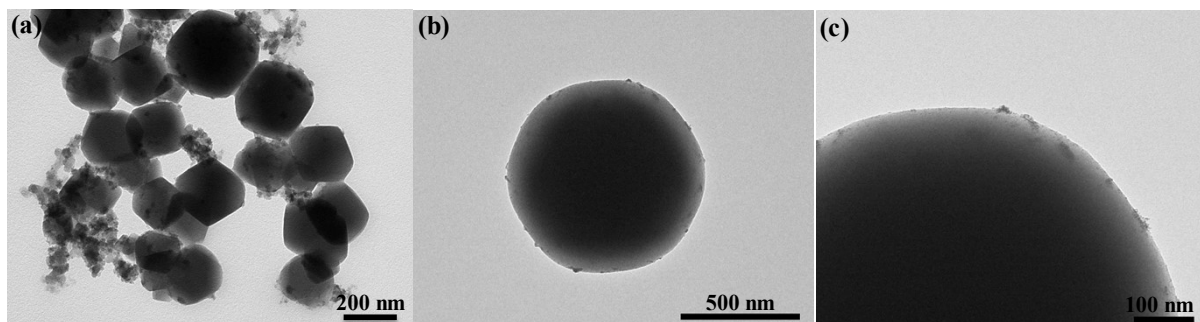
**Fig. S1.** Digital image of equipment for the photo-thermal CO<sub>2</sub> hydrogenation and the schematic illustration of the reactor.



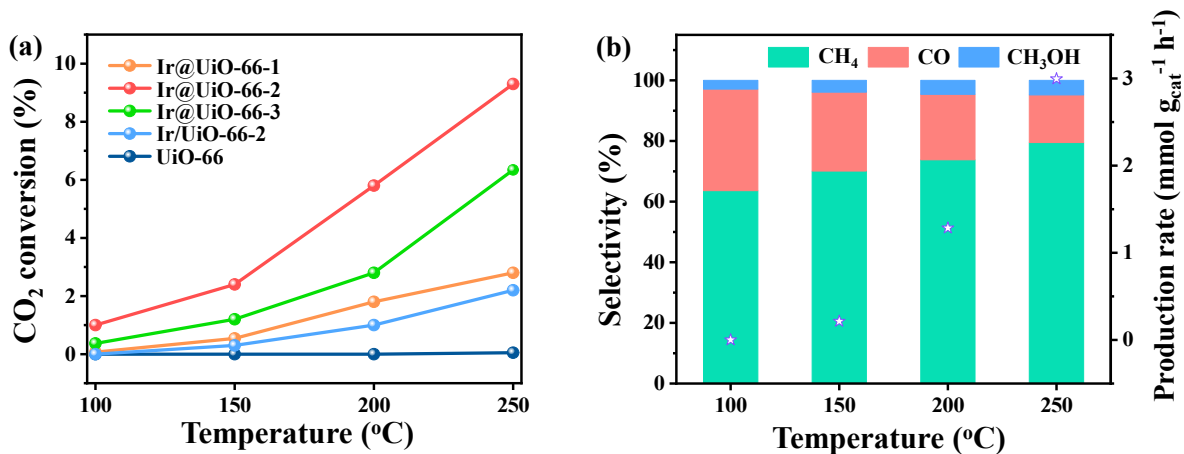
**Fig. S2.** (a) XPS survey spectra of UiO-66 and Ir@UiO-66; (b) XPS core-level spectra of Ir 4f of Ir nanoparticles and Ir/UiO-66-2.



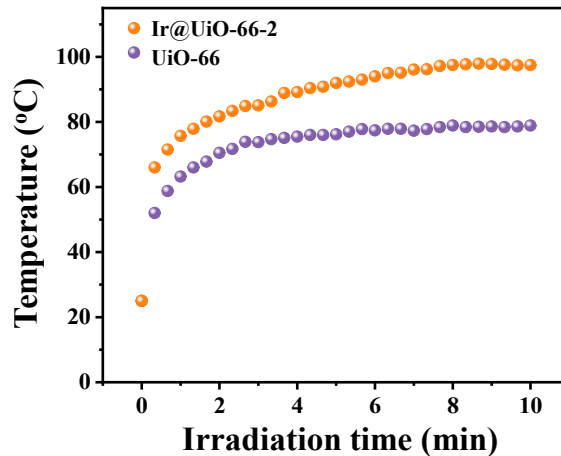
**Fig. S3.** (a) TEM image and the size distribution histogram (inset) of Ir nanoparticles; (b) HRTEM image of the Ir nanoparticles.



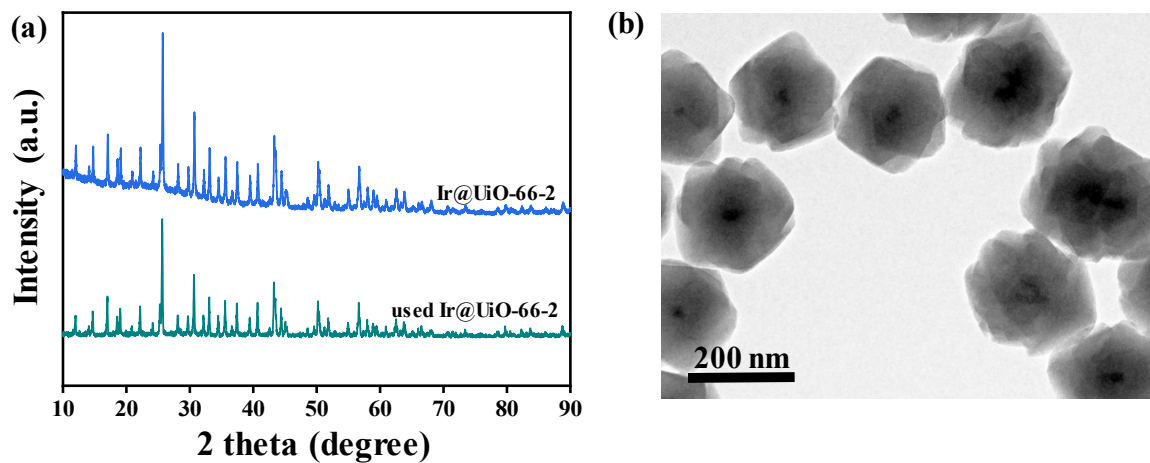
**Fig. S4.** TEM images of (a) Ir@UiO-66-2 without PVP and (b-c) Ir/UiO-66-2.



**Fig. S5.** (a) CO<sub>2</sub> conversion rate of UiO-66, Ir@UiO-66 and Ir/UiO-66 catalysts at different temperatures, (b) product selectivity and CH<sub>4</sub> yield rate of Ir@UiO-66-2 catalyst at different temperatures in dark.

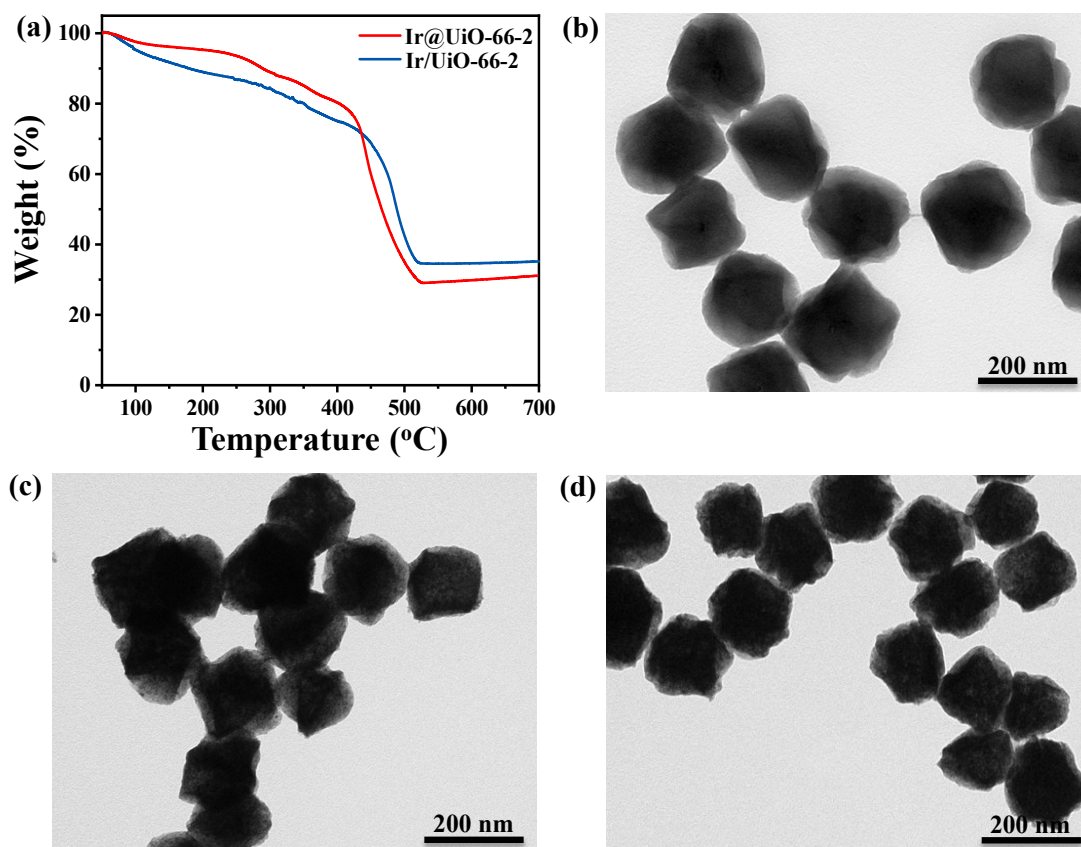


**Fig. S6.** Temperature profiles of UiO-66 and Ir@UiO-66-2 under light irradiation.



**Fig. S7.** (a) XRD patterns of Ir@UiO-66-2 before and after CO<sub>2</sub> hydrogenation test;

(b) TEM image of Ir@UiO-66-2 after CO<sub>2</sub> hydrogenation test.



**Fig. S8.** TGA curves of UiO-66, Ir@UiO-66-2 and Ir/UiO-66-2; (b-c) TEM images of

Ir@UiO-66 calcined for 2 h in nitrogen at 400 °C, 450 °C and 500 °C, respectively.

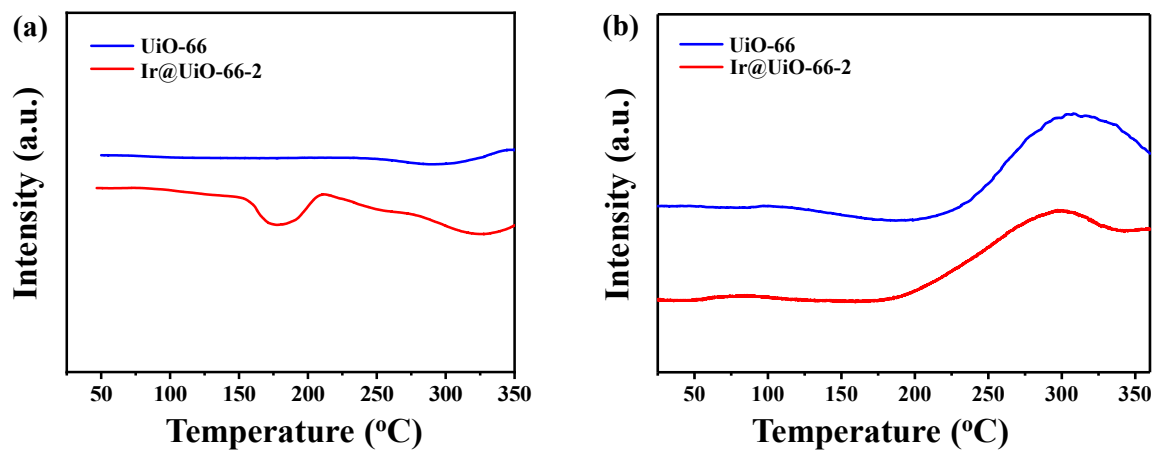


Fig. S9. (a) H<sub>2</sub>-TPR and (b) CO<sub>2</sub>-TPD profiles of UiO-66 and Ir@UiO-66-2.

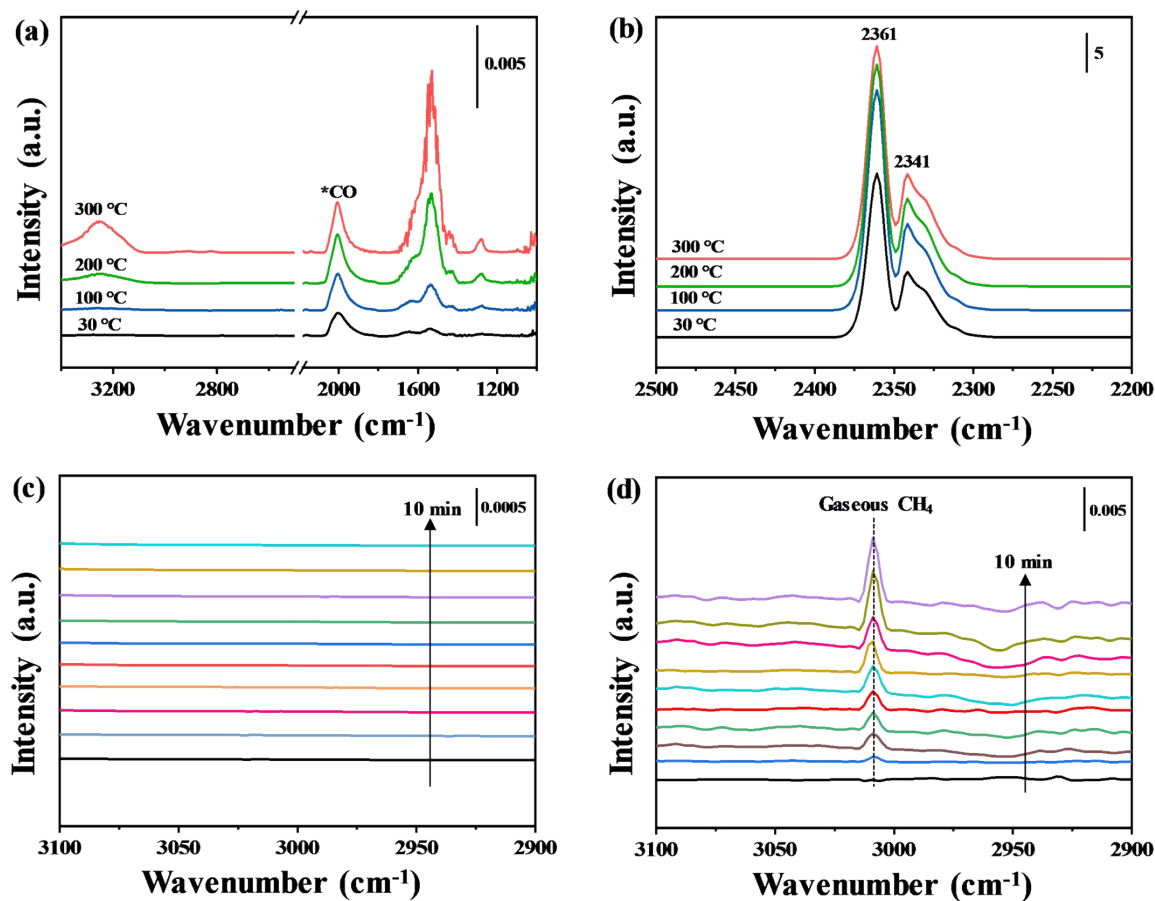


Fig. S10. (a-b) *In situ* DRIFTS spectra of Ir@UiO-66-2 catalyst under exposure to the mixture of H<sub>2</sub> and CO<sub>2</sub> (2:1) from 30 °C to 300 °C; *In situ* DRIFTS spectra of Ir@UiO-66-2 catalyst in dark (c) and under light irradiation (d) at 300 °C for 10 min.