Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Supporting information

Construction of Ru doped In_2O_3 hollow peanut-like structure for enhanced photocatalytic nitrogen reduction under solar light irradiation

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Number of figures: 7

Determination of ammonia

The ammonia concentration was spectrophotometrically measured by the indophenol blue method. Briefly, 1 mL of reacted solution was removed from the photoreactor. Next, 2 mL of 1M NaOH containing 5 wt% salicylic acid and 5 wt% sodium citrate, 1 mL of 0.05 M NaClO and 0.2 mL of 1 wt% $C_5FeN_6Na_2O$ (sodium nitroferricyanide) were sequentially added to the solution. After 2h at ambient temperature, 2 mL of as-prepared solution was drawn out for UV-Vis measurement at a wavelength of 655 nm to determine the formation on indophenol blue (**Figure S1**) . For the calibration of the concentration-absorbance curve, standard ammonia chloride solution with the concentration of 10, 20, 30, 40, 50, 100 μM in 10 vol% MeOH were used (Figure S.1), which contained the same concentration of MeOH as in the testing solution.

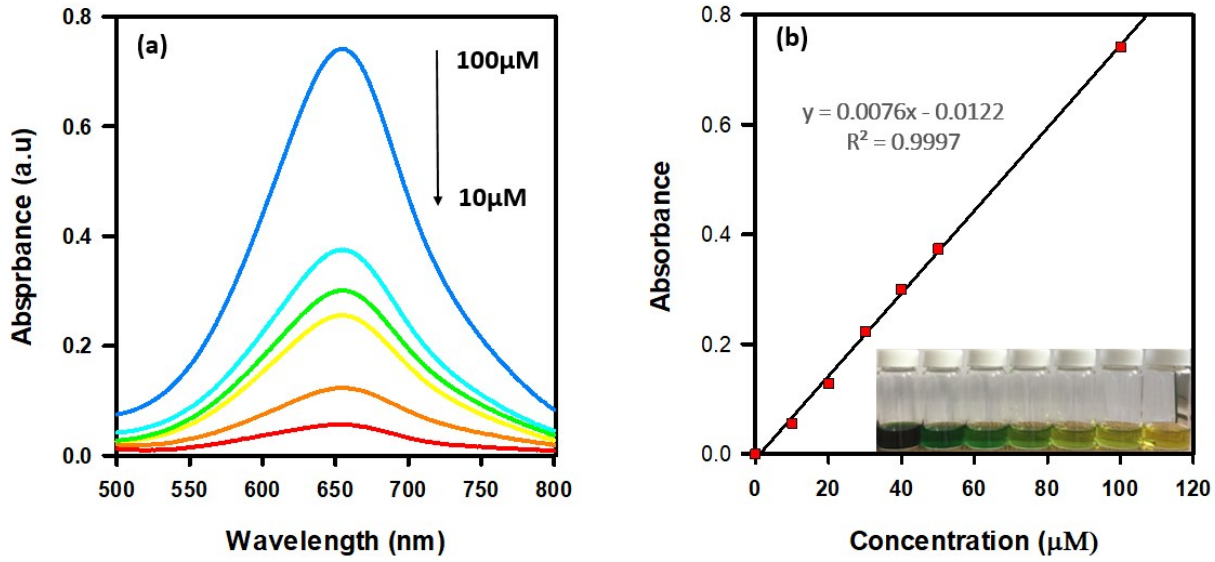

Figure S1: (a) UV-vis spectra for ammonium quantification using the indophenol-blue method with the concentration of 10, 20, 30, 40, 50, 100 µM in 10 vol% MeOH, respectively; (b) The calibration curve for ammonium quantification (NH_4^+ concentration versus absorbance at 655 nm).

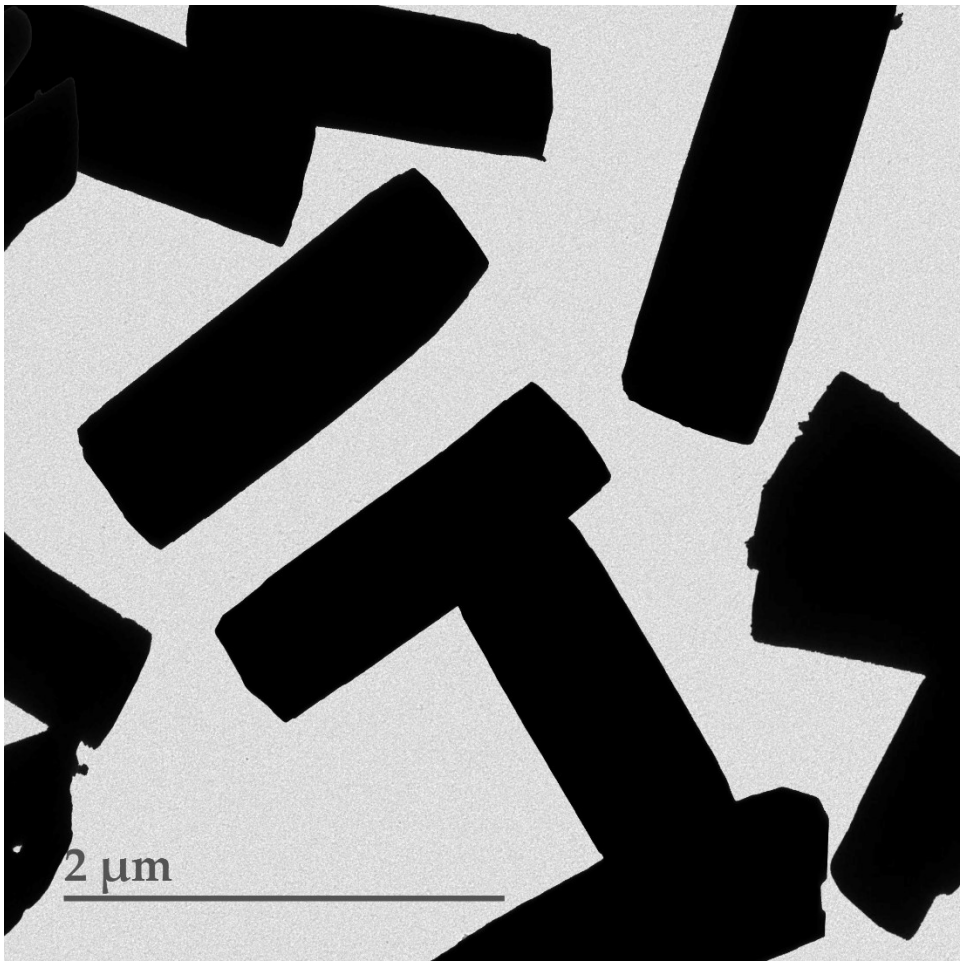

Figure S2 The TEM images of MIL-68-In(Ru) precursors for 1h reaction.

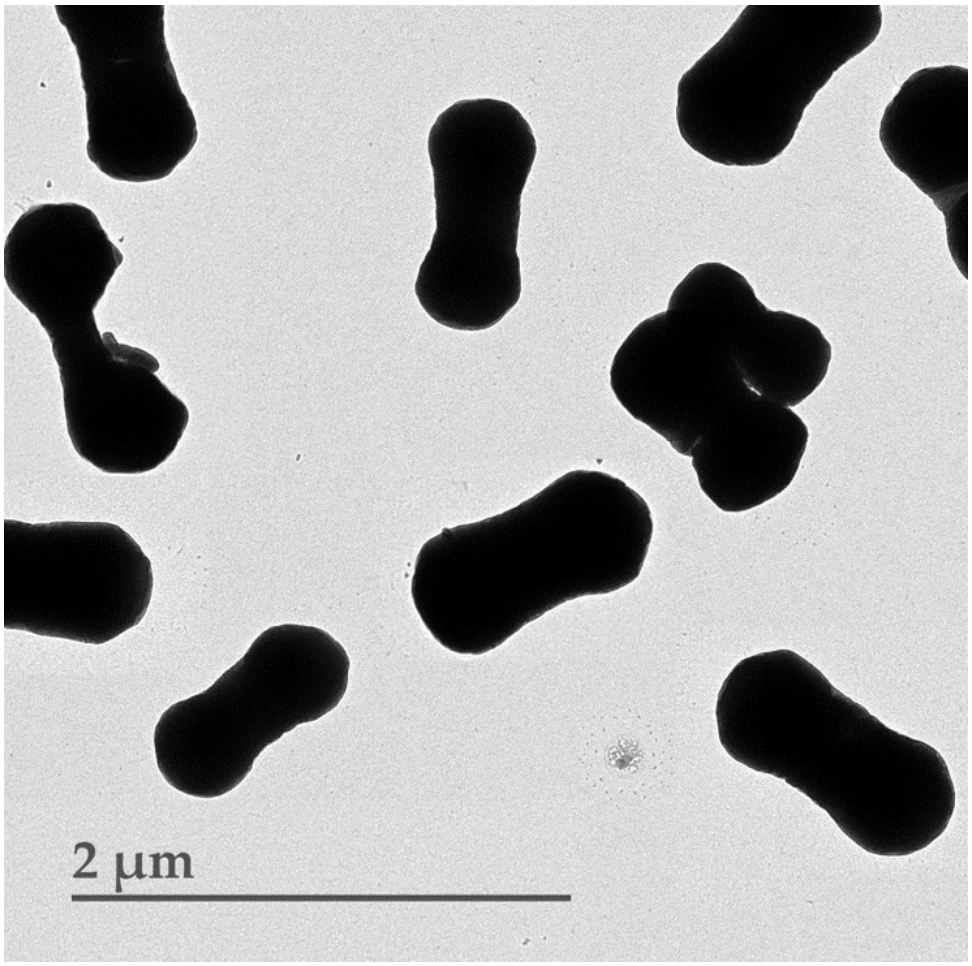

Figure S3 The TEM images of MIL-68-In(Ru) precursors with 2% Ru doping.

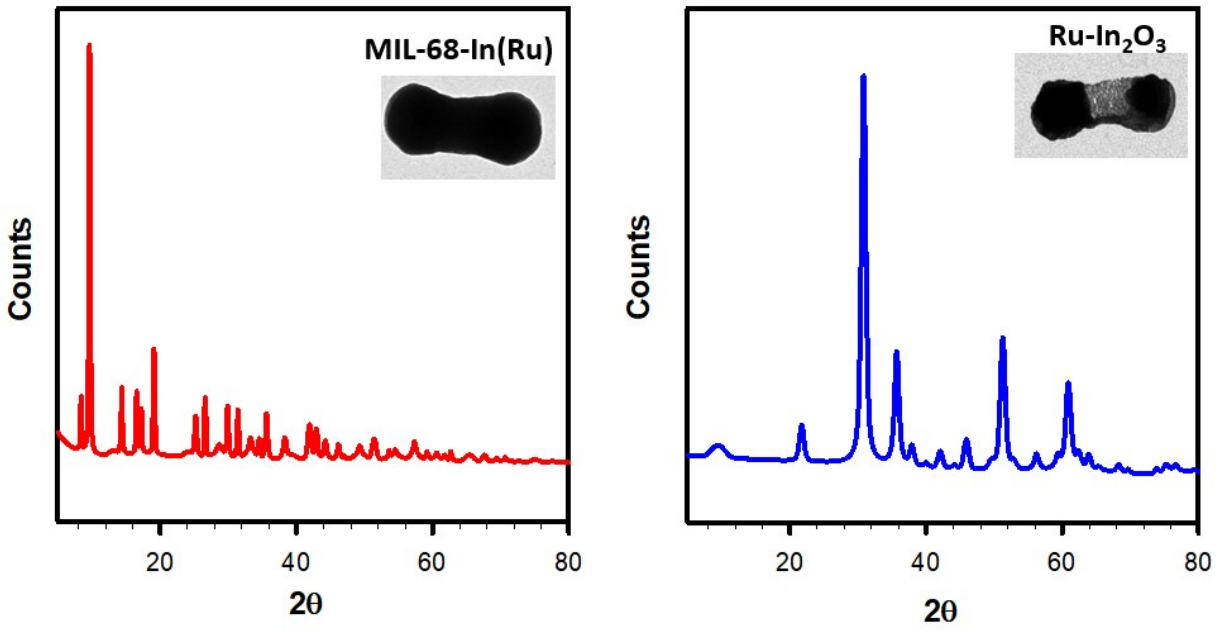

Figure S4: X-ray diffraction spectra of MIL-68-In(Ru) and Ru-In_2O_3 hollow peanut samples

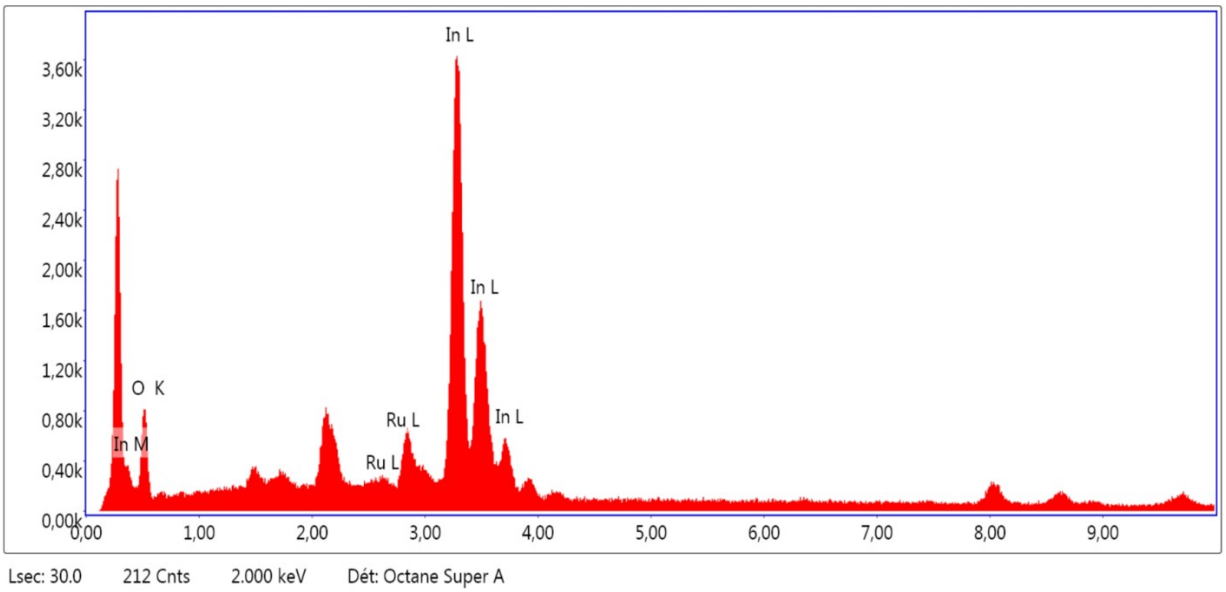

Figure S5: Representative EDX analysis collected on 2wt % Ru-In_2O_3 HPNs samples

EDX spectrum confirms that Ru-In_2O_3 HPNs mainly compose of Ru, In and O. The Cu signals are from the substrate

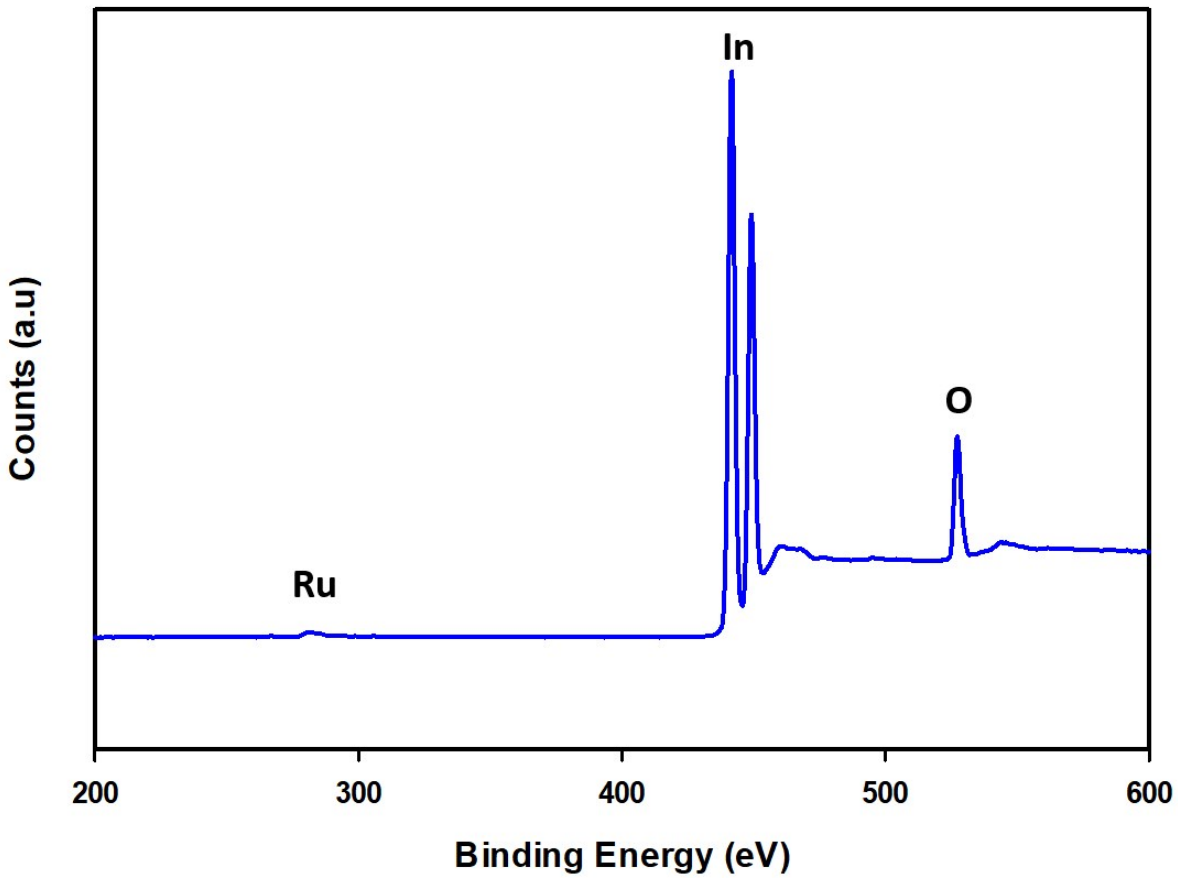

Figure S6: Survey XPS spectra of 2 wt% Ru-In_2O_3

XPS spectrum confirms that Ru-In_2O_3 HPNs mainly compose of Ru, In and O

Element	Composition
In	39.81%
O	58.45%
Ru	0.56%

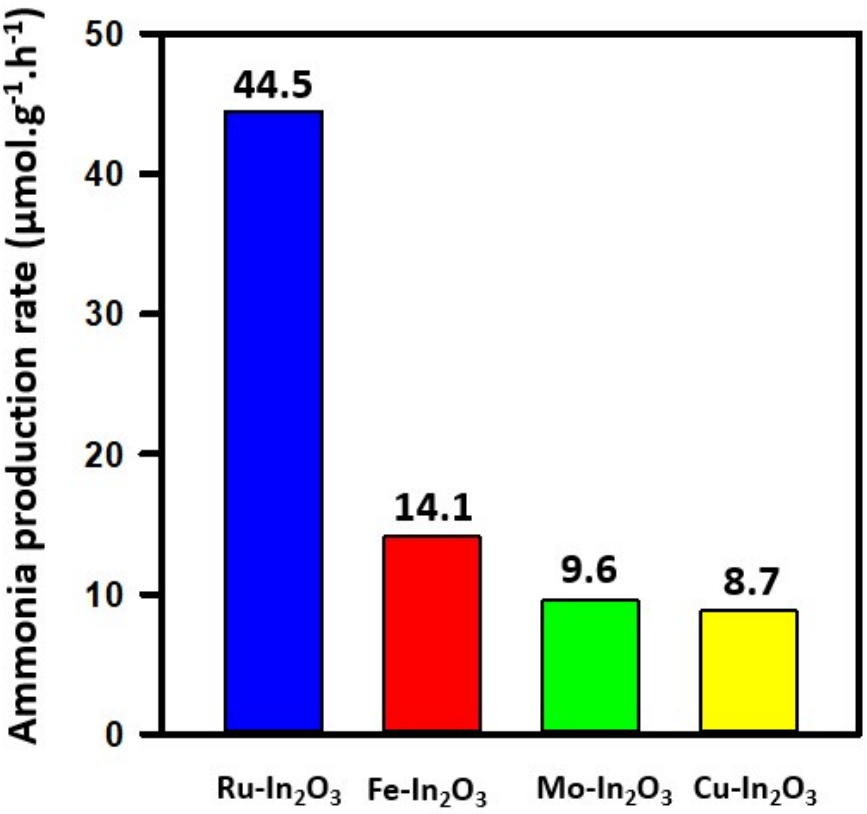

Figure S7: Photocatalytic NH_3 production rate of different transition metal dopants

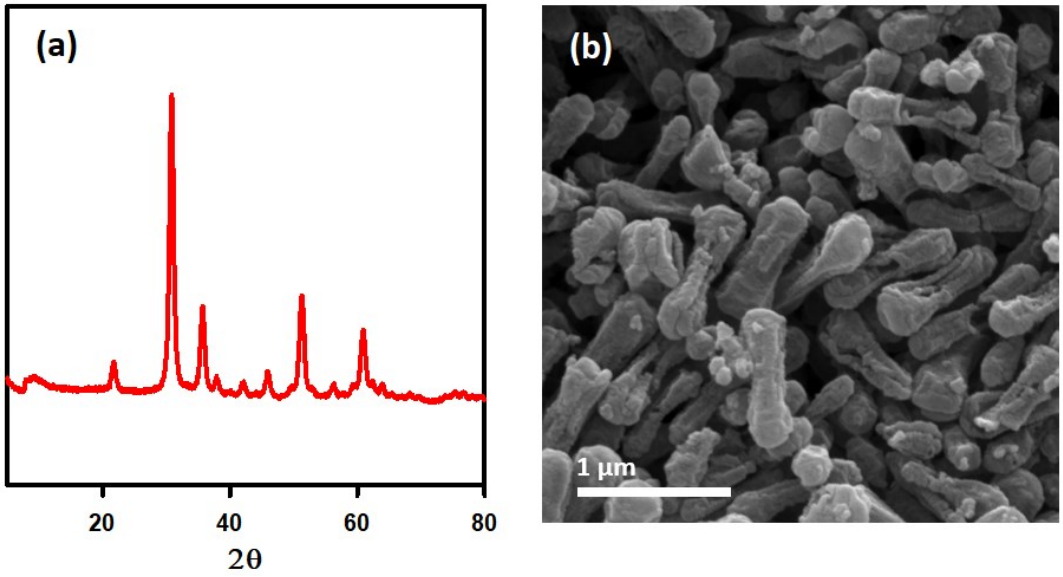

Figure S8: (a) X-ray diffraction spectra and (b) SEM images of 2% Ru-In_2O_3 hollow peanuts after 6 cycles of photocatalytic test

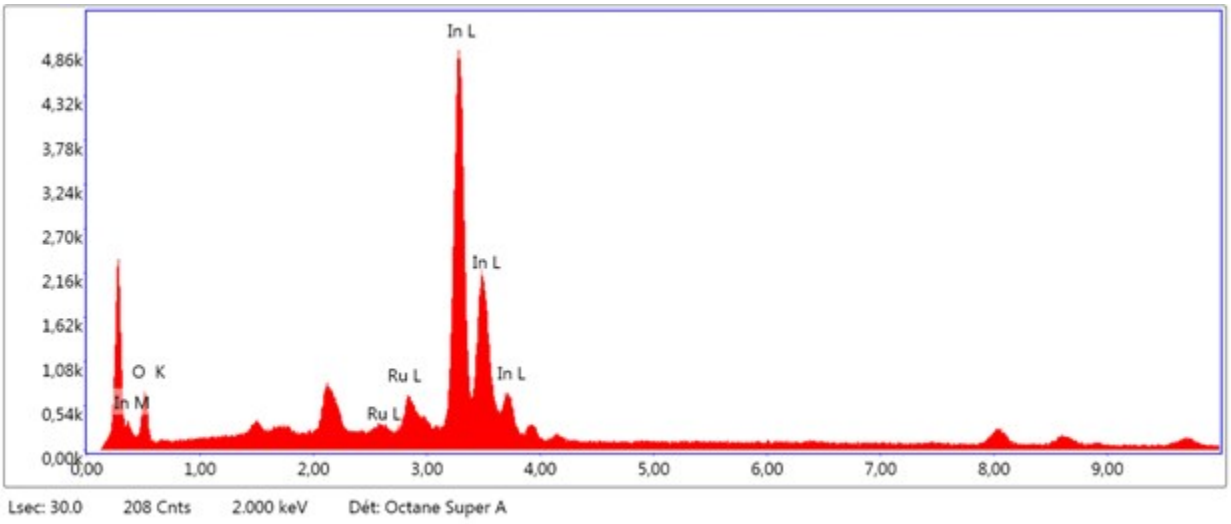

Figure S9: EDX analysis collected on 2wt % Ru-In_2O_3 HPNs samples hollow peanuts after 6 cycles of photocatalytic test