Supplementary Information

One-Step Polyol Method for Well-Dispersed and Heavy-Loaded Ir and Ru Catalysts in Hydrazine Decomposition

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1. Characterization Data

1.1 XRPD pattern of commercial Ir/Al_2O_3

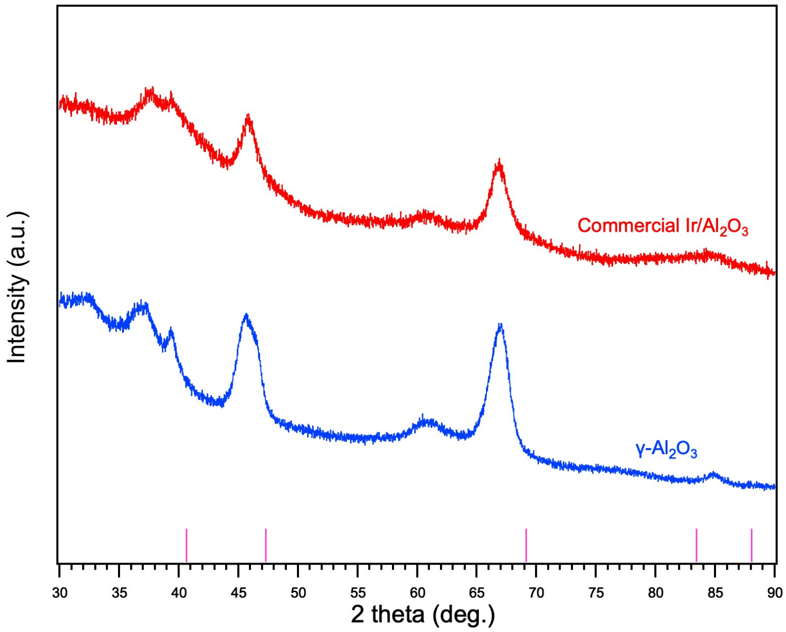

Fig. S1 XRPD patterns of commercial Ir/Al_2O_3 (red) and γ-Al_2O_3 (blue). The pink line is the standard peaks for fcc-Ir (JCPDS no. 06-0598).

1.2 TEM and histogram of commercial Ir/Al_2O_3

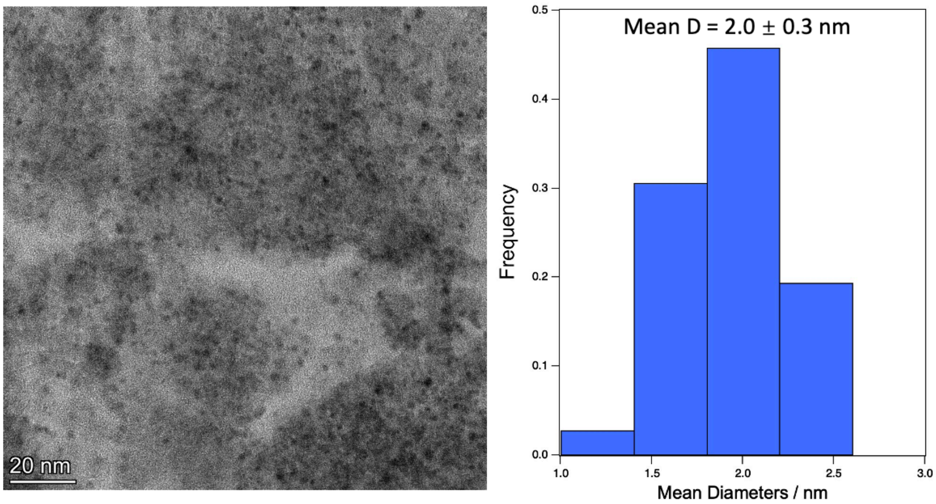

Fig. S2 TEM image and histogram of commercial Ir/Al_2O_3.

2. Calculation details

2.1 The Apparent Activation Energy for Ir catalyst

From the Arrhenius equation,

$$k = A\, e^{-E_a/RT}$$

k is the reaction rate constant at reaction temperature, *A* is the frequency factor, E_a is the apparent activation energy, T is the reaction temperature and R is the molar gas constant.

Take the logarithm of the formula,

$$lnk = lnA - \frac{E_a}{RT}$$

Then Linear fit to the curve consisting of *k* values obtained at different temperatures, the trend line equation of Ir catalyst can be calculated as,

$$ln\,[k/(\mathrm{mmol\ g_{Ir}^{-1}\ h^{-1}})] = -\frac{6361.6}{T} + 31.253 \quad R^2 = 0.9594$$

$$\frac{-E_a}{R} = -6361.6\ \mathrm{K},$$

So, E_a = 6361.6 K × 8.3145 J K^{-1} mol^{-1} = 52.89 kJ mol^{-1} = 0.55 eV

$$ln\,[A/(\mathrm{mmol\ g_{Ir}^{-1}\ h^{-1}})] = 31.253$$

So, $A = 3.74 \times 10^{13}$ mmol g_{Ir}^{-1} h^{-1}

2.2 The Apparent Activation Energy for Ru catalyst

From the Arrhenius equation,

$$k = A\, e^{-E_a/RT}$$

k is the reaction rate constant at reaction temperature, *A* is the frequency factor, E_a is the apparent activation energy, T is the reaction temperature and R is the molar gas constant.

Take the logarithm of the formula,

$$lnk = lnA - \frac{E_a}{RT}$$

Then Linear fit to the curve consisting of k values obtained at different temperatures, the trend line equation of Ru catalyst can be calculated as,

$$ln[k/(\text{mmol g}_{\text{Ru}}^{-1}\ \text{h}^{-1})] = -\frac{5242.2}{T} + 24.943 \quad R^2 = 0.9733$$

$$\frac{-E_a}{R} = -5242.2\ \text{K},$$

So, E_a = 5242.2 K × 8.3145 J K^{-1} mol^{-1} = 45.26 kJ mol^{-1} = 0.47 eV

$$ln[A/(\text{mmol g}_{\text{Ru}}^{-1}\ \text{h}^{-1})] = 24.943$$

So, $A = 6.80 \times 10^{10}$ mmol g_{Ru}^{-1} h^{-1}