SUPPORTING INFORMATION

Al_2O_3-supported transition metals for plasma-catalytic NH_3 synthesis in a DBD plasma: Metal activity and insights into mechanisms

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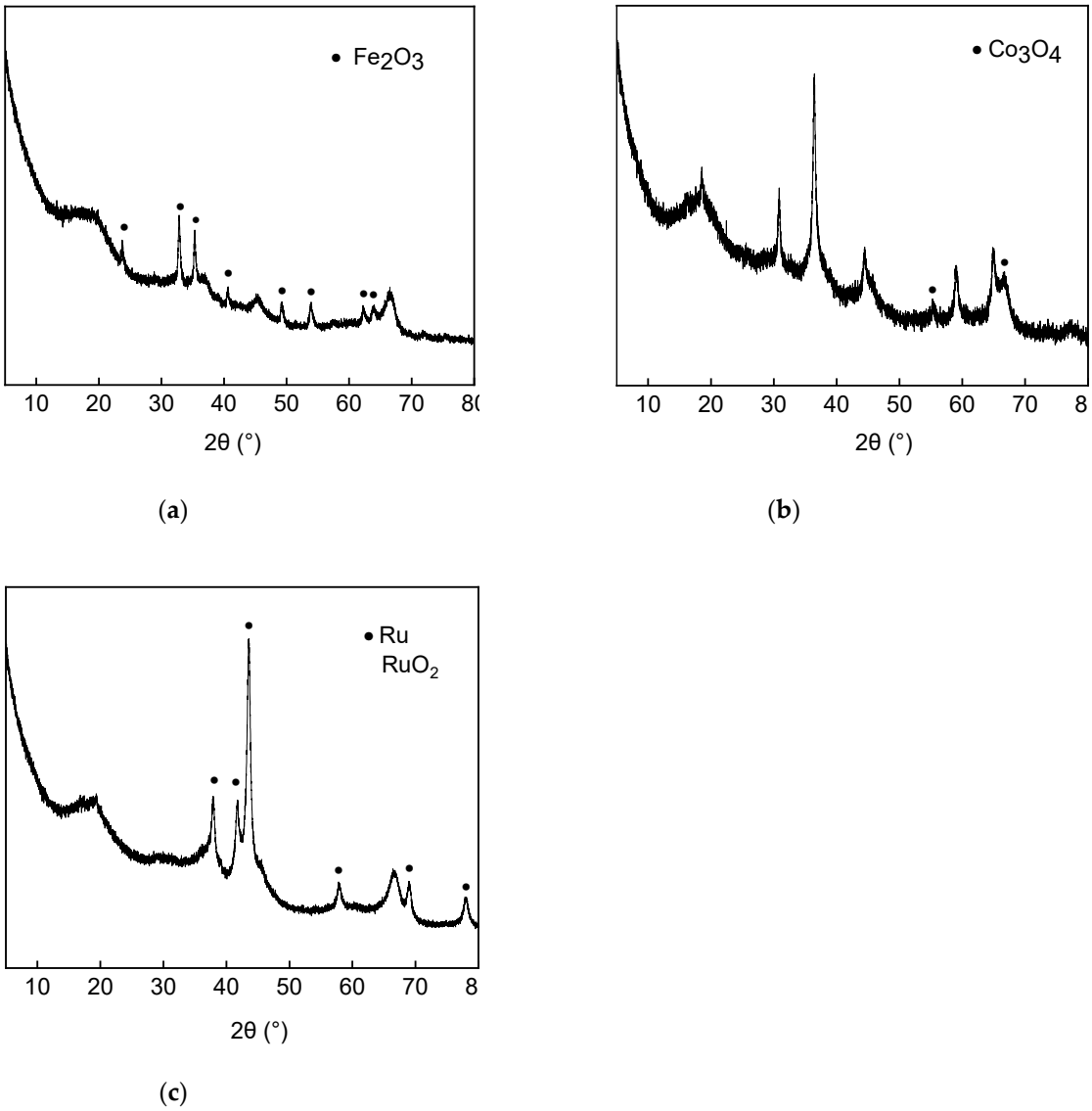
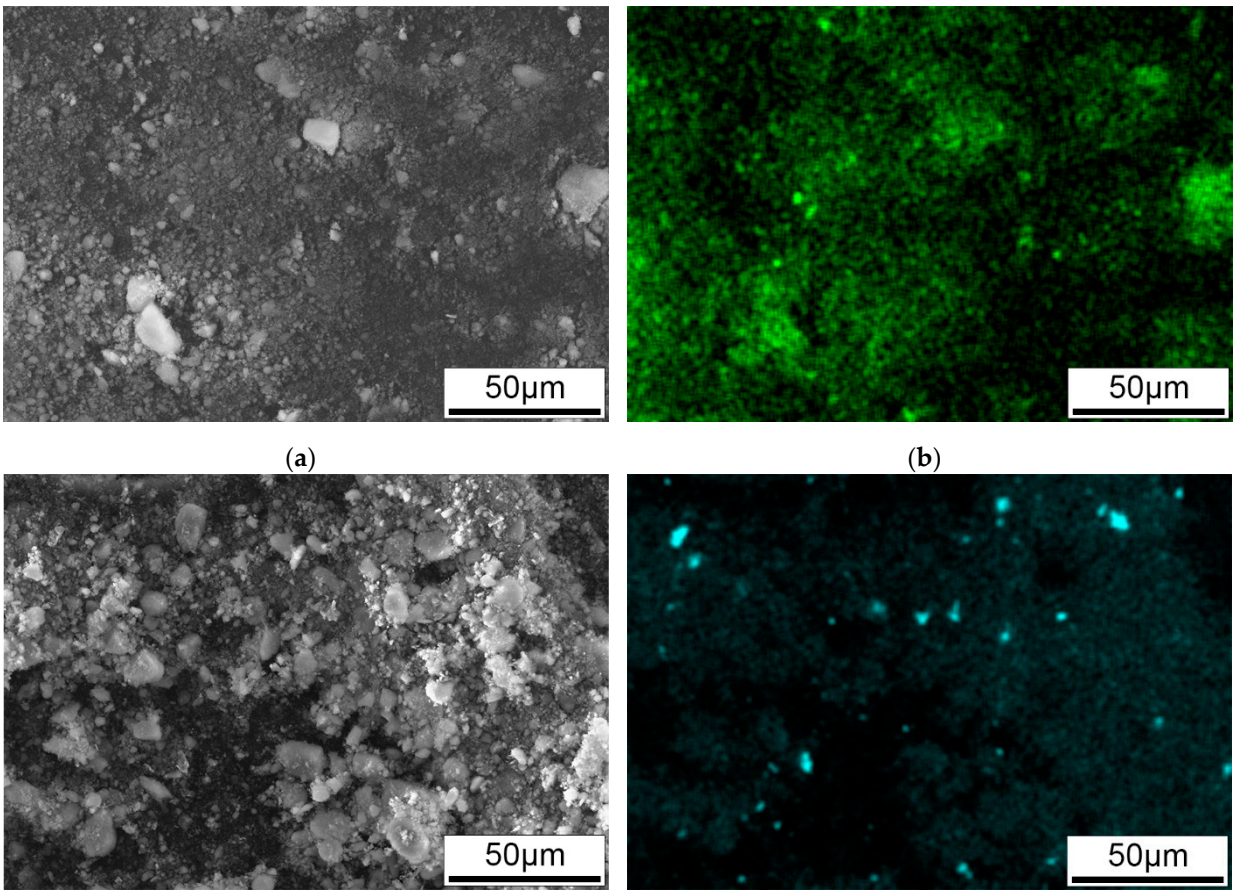


Figure S1. XRPD diffractograms of the catalysts used in our work. (**a**) Fe_2O_3/Al_2O_3 (after calcination, before reduction); (**b**) Co_3O_4/Al_2O_3 (after calcination, before reduction); (**c**) Ru/Al_2O_3 (after calcination, after reduction).

Table S1. Measured active surface area (S_{BET}) and pore volume (V) for the 10 wt% Co/Al_2O_3 catalyst before (fresh) and after (spent) the plasma-catalytic NH_3 synthesis experiments, showing no difference before and after the plasma experiments. The other catalysts showed similar behaviour.

Material	S_{BET} (m^2/g)	V (cm^3/g)
10 wt% Co/Al_2O_3 (fresh)	175	0.37
10 wt% Co/Al_2O_3 (spent)	177	0.37



(**a**) (**b**)

(**c**) (**d**)

Figure S2. Typical SEM-EDX images of the catalysts, for the example of 10 wt% Co and Cu/Al_2O_3 catalysts with EDX maps applied for visualisation of the respective metals. (**a**) SEM image of the 10 wt% Co/Al_2O_3; (**b**) SEM EDX map of Co on the surface of the 10 wt% Co/Al_2O_3; (**c**) SEM image of the 10 wt% Cu/Al_2O_3; (**d**) SEM EDX map of Cu on the surface of the 10 wt% Cu/Al_2O_3. Green and cyan colours indicate the particles of the respective metal on the surface of Al_2O_3.

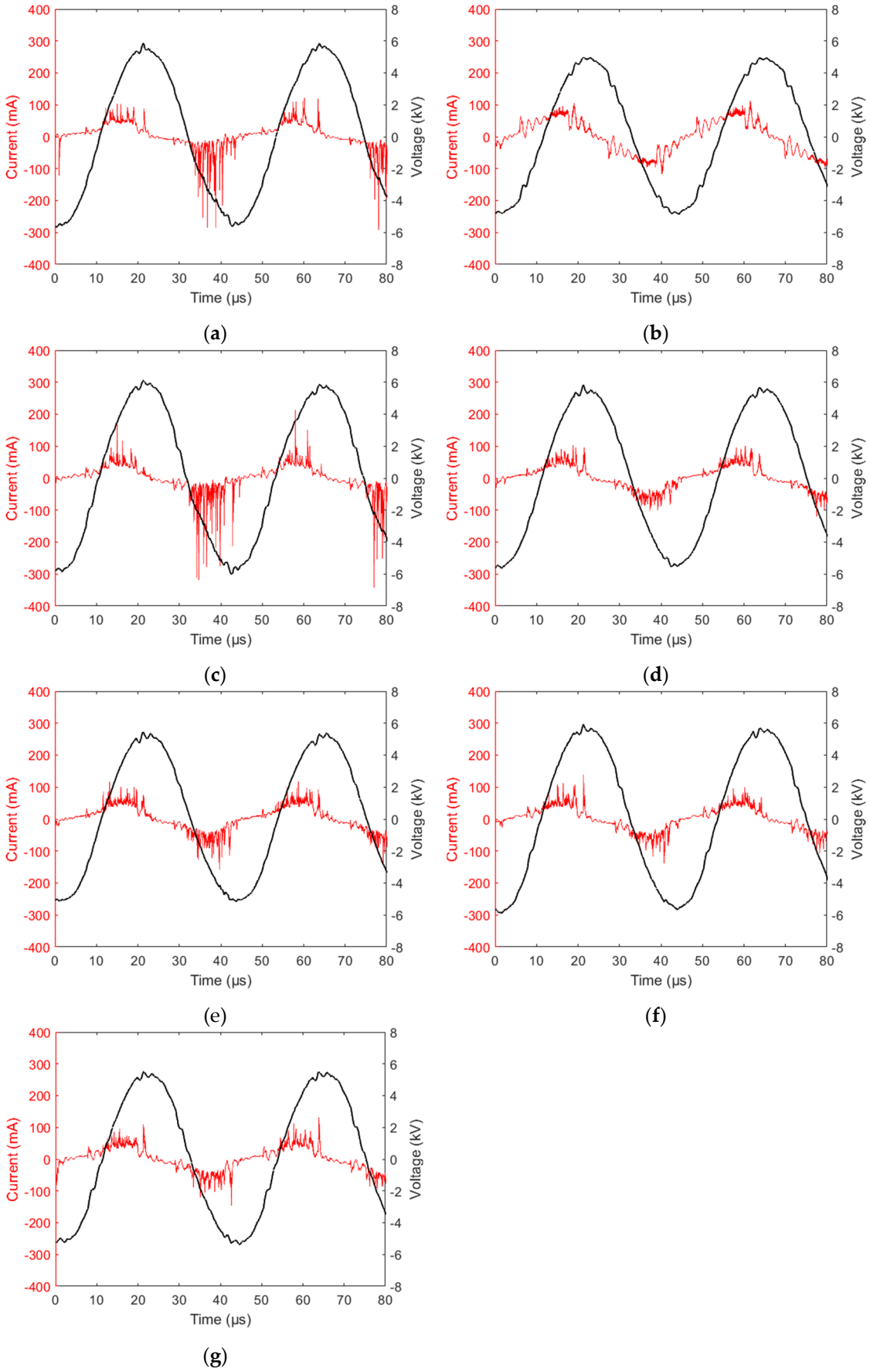


Figure S3. Current and voltage waveforms for the plasma-catalytic NH_3 synthesis experiments with different Al_2O_3-supported catalysts and pristine Al_2O_3, at different H_2:N_2 ratios in the feed gas. (**a**) Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**b**) 10 wt% Fe/Al2O at the 1:1 H_2/N_2 gas ratio; (**c**) 10 wt% Ru/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**d**) 10 wt% Co/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**e**) 10 wt% Cu/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**f**) 10 wt% Co/Al_2O_3 at the 1:3 H_2/N_2 gas ratio; (**g**) 10 wt% Co/Al_2O_3 at the 3:1 H_2/N_2 gas ratio.

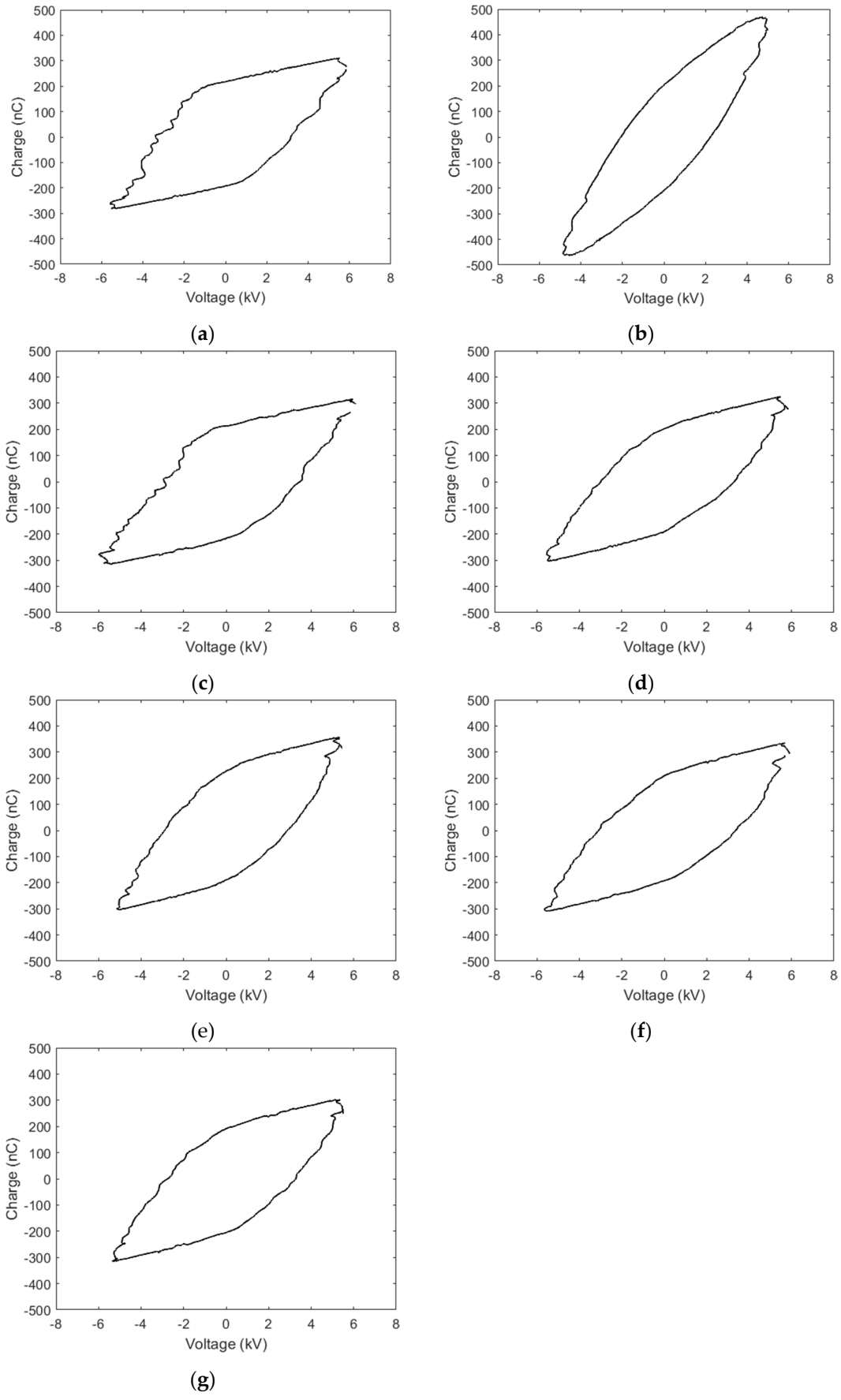


Figure S4. Lissajous figures for the plasma-catalytic NH_3 synthesis experiments with different Al_2O_3-supported catalyst and pristine Al_2O_3, at the different H_2:N_2 ratios in the feed gas. (**a**) Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**b**) 10 wt% Fe/Al2O at the 1:1 H_2/N_2 gas ratio; (**c**) 10 wt% Ru/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**d**) 10 wt% Co/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**e**) 10 wt% Cu/Al_2O_3 at the 1:1 H_2/N_2 gas ratio; (**f**) 10 wt% Co/Al_2O_3 at the 1:3 H_2/N_2 gas ratio ; (**g**) 10 wt% Co/Al_2O_3 at the 3:1 H_2/N_2 gas ratio.

Table S2. The amount of the used catalyst, and the production rate of NH_3 (in mg/(h×g_{cat}) in our work compared to literature reports.

Reference in the main text	Catalyst amount (g)	NH_3 production rate	
		mg/h	mg/(h × g_{cat})
[35]	17	119	6.9
[36]	173	32	0.2
[39]	3.6	76	21
[42]	100	17	0.2
[46]	0.5	25	50
this work	12	42	3.5