

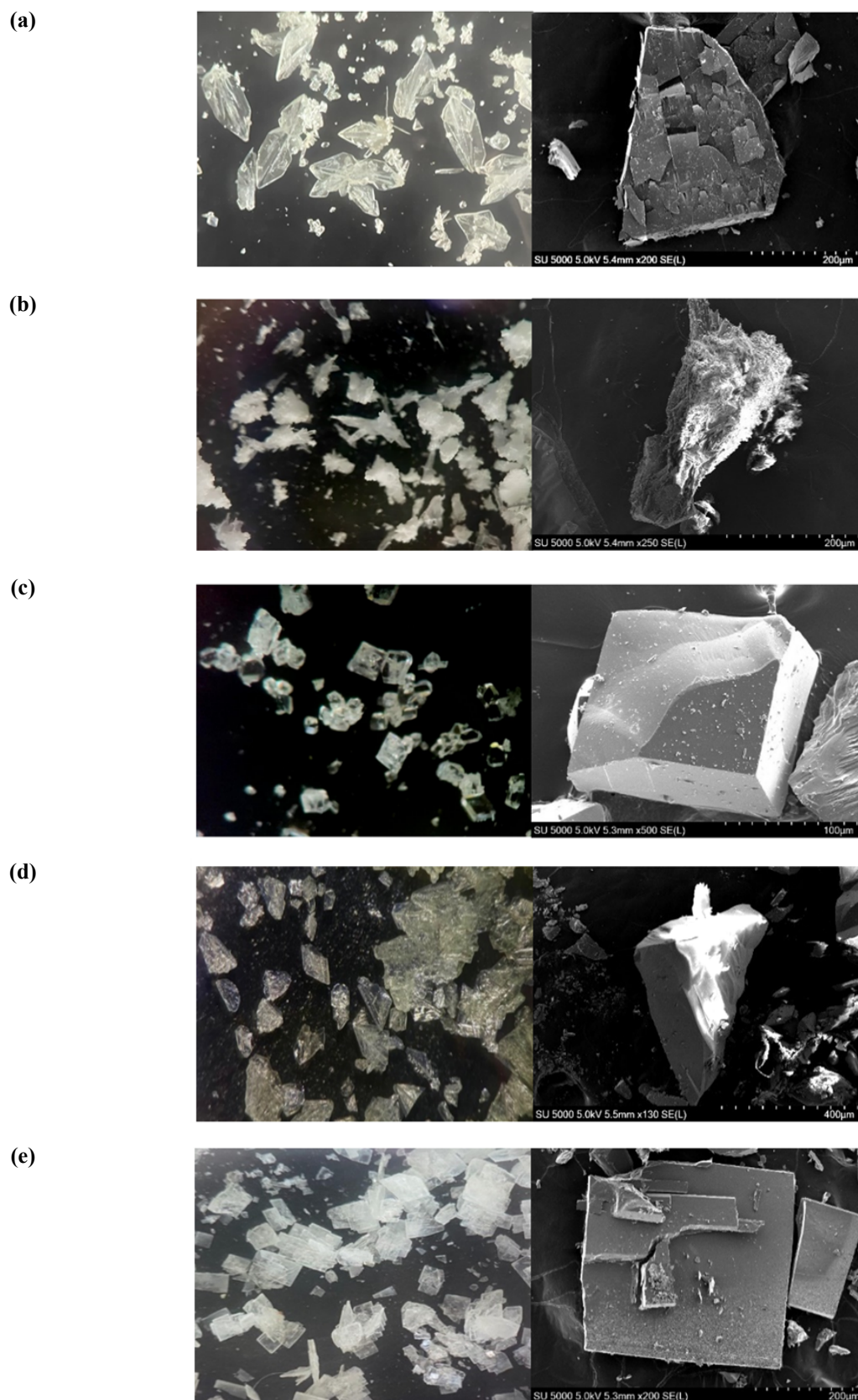


Figure S1. Optical microscope and SEM photographs of crystals of complexes 1(a), 2(b), 3(c), 4(d) and 5(e)

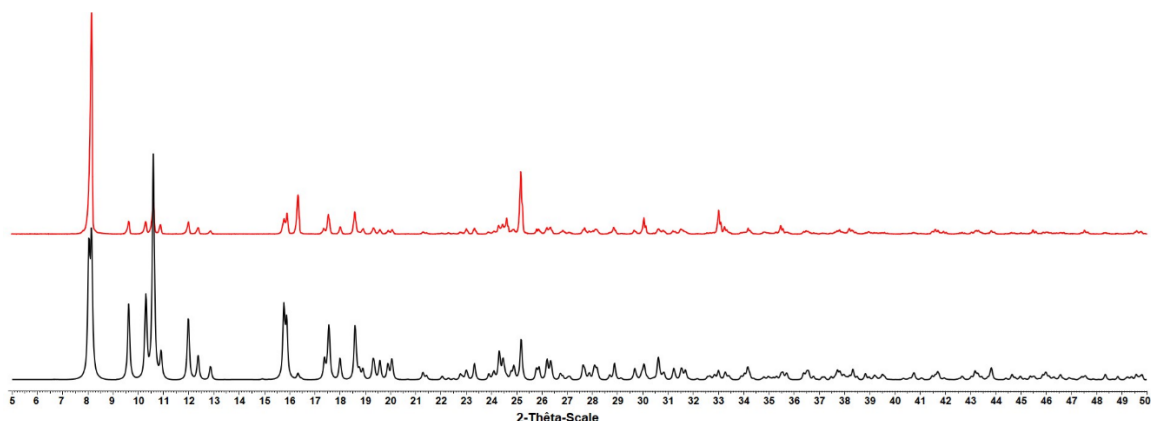


Figure S2a. Comparison of the experimental powder XRD pattern (red line) of complex **1** with the calculated one (black line). X-ray source; Copper $K\alpha$ radiation.

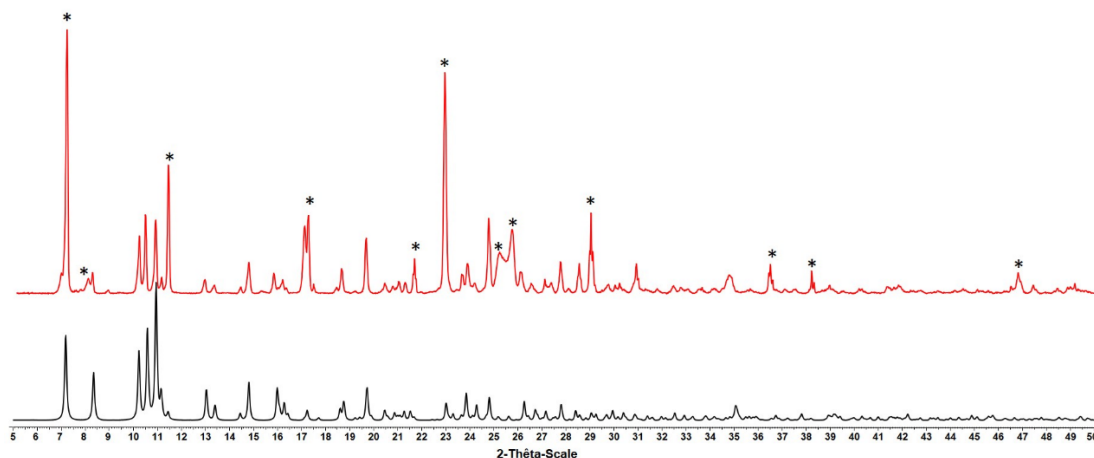


Figure S2b. Comparison of the experimental powder XRD pattern (red line) of complex **2** with the calculated one (black line). X-ray source; Copper $K\alpha$ radiation. The (*) represent unidentified crystalline impurities within the sample.

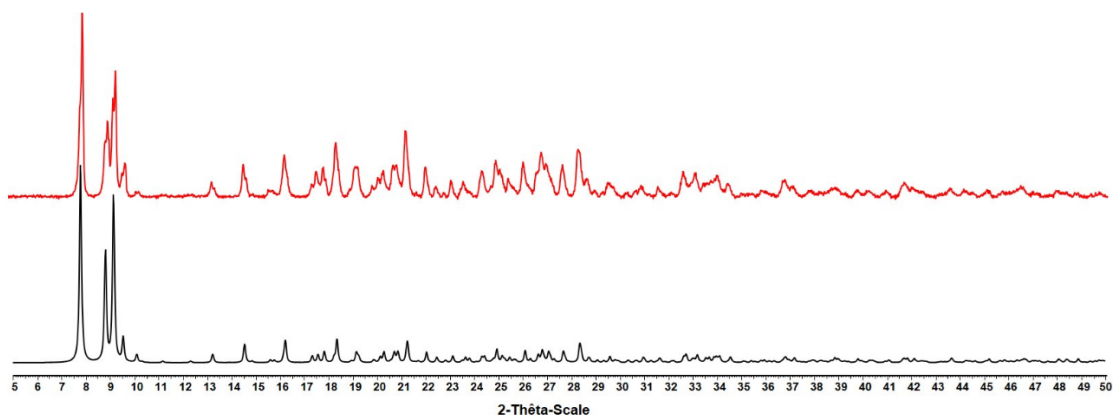


Figure S2c. Comparison of the experimental powder XRD pattern (red line) of complex **3** with the calculated one (black line). X-ray source; Copper $K\alpha$ radiation.

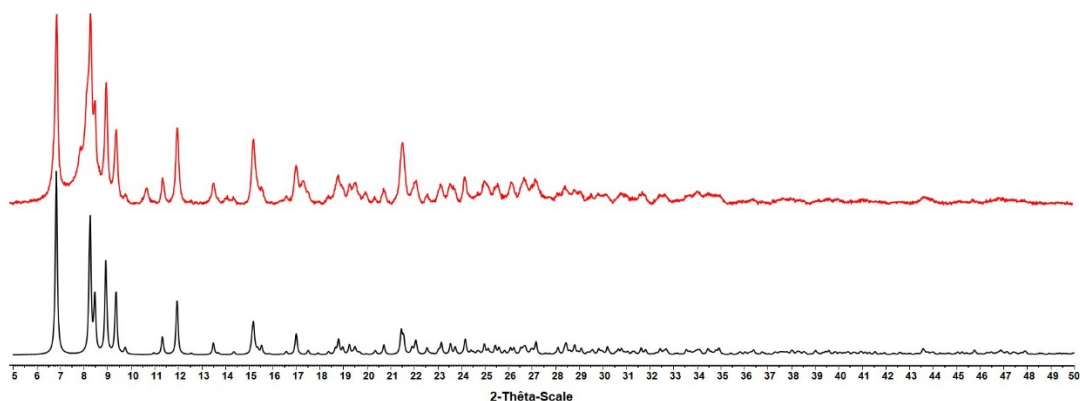


Figure S2d. Comparison of the experimental powder XRD pattern (red line) of complex **4** with the calculated one (black line). X-ray source; Copper $K\alpha$ radiation.

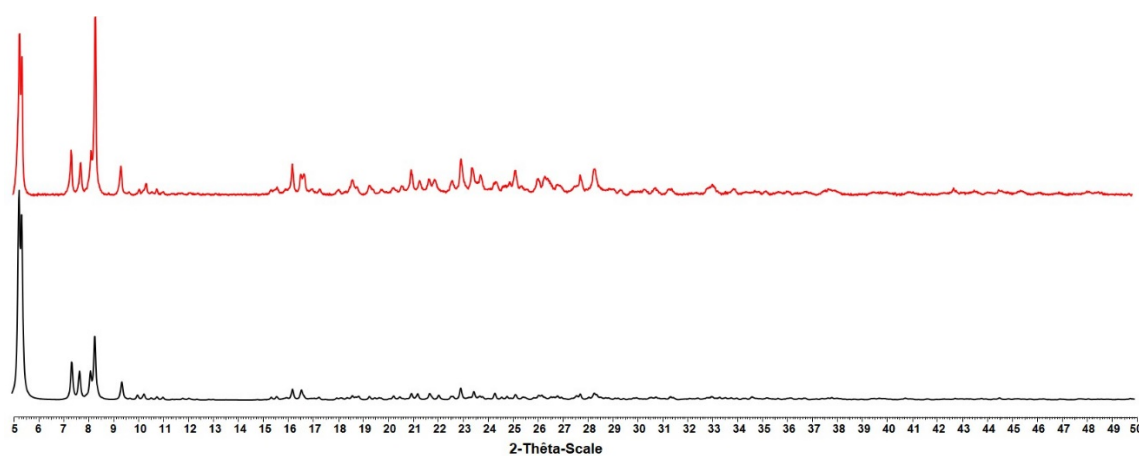


Figure S2e. Comparison of the experimental powder XRD pattern (red line) of complex **5** with the calculated one (black line). X-ray source; Copper $K\alpha$ radiation.

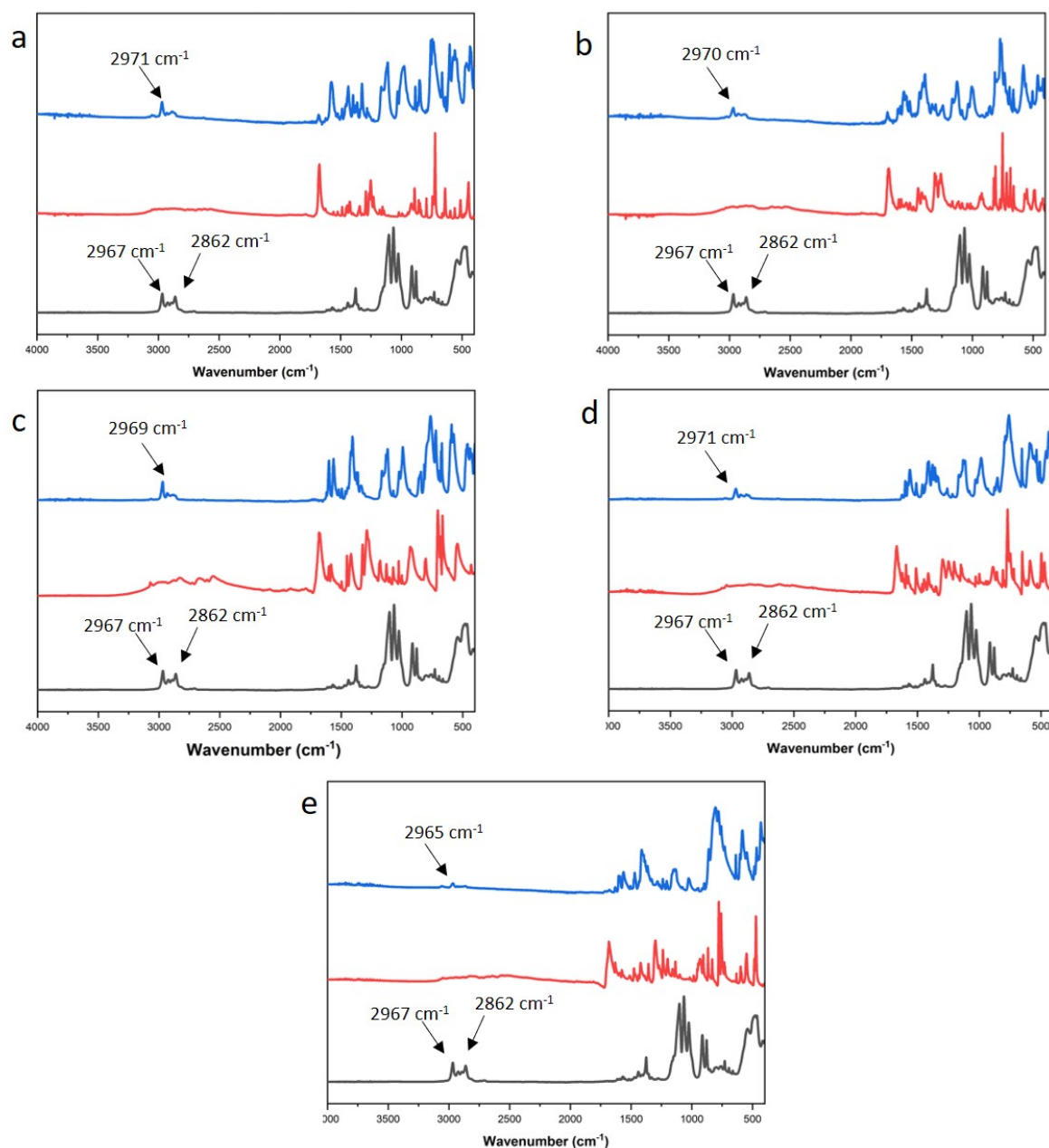


Figure S3a. Infrared spectroscopy analysis in the 4000 – 400 cm^{-1} range for the tantalum complexes **1** (a), **2** (b), **3** (c), **4** (d), **5** (e) (blue lines). The free ligands anthracene-9-carboxylic acid (a), 4'-methylbiphenyl-4-carboxylic acid (b), benzoic acid (c), 1-naphtoic acid (d) and 2-naphtoic acid (e) (red lines) and the tantalum precursor $\text{Ta}(\text{OEt})_5$ (black lines).

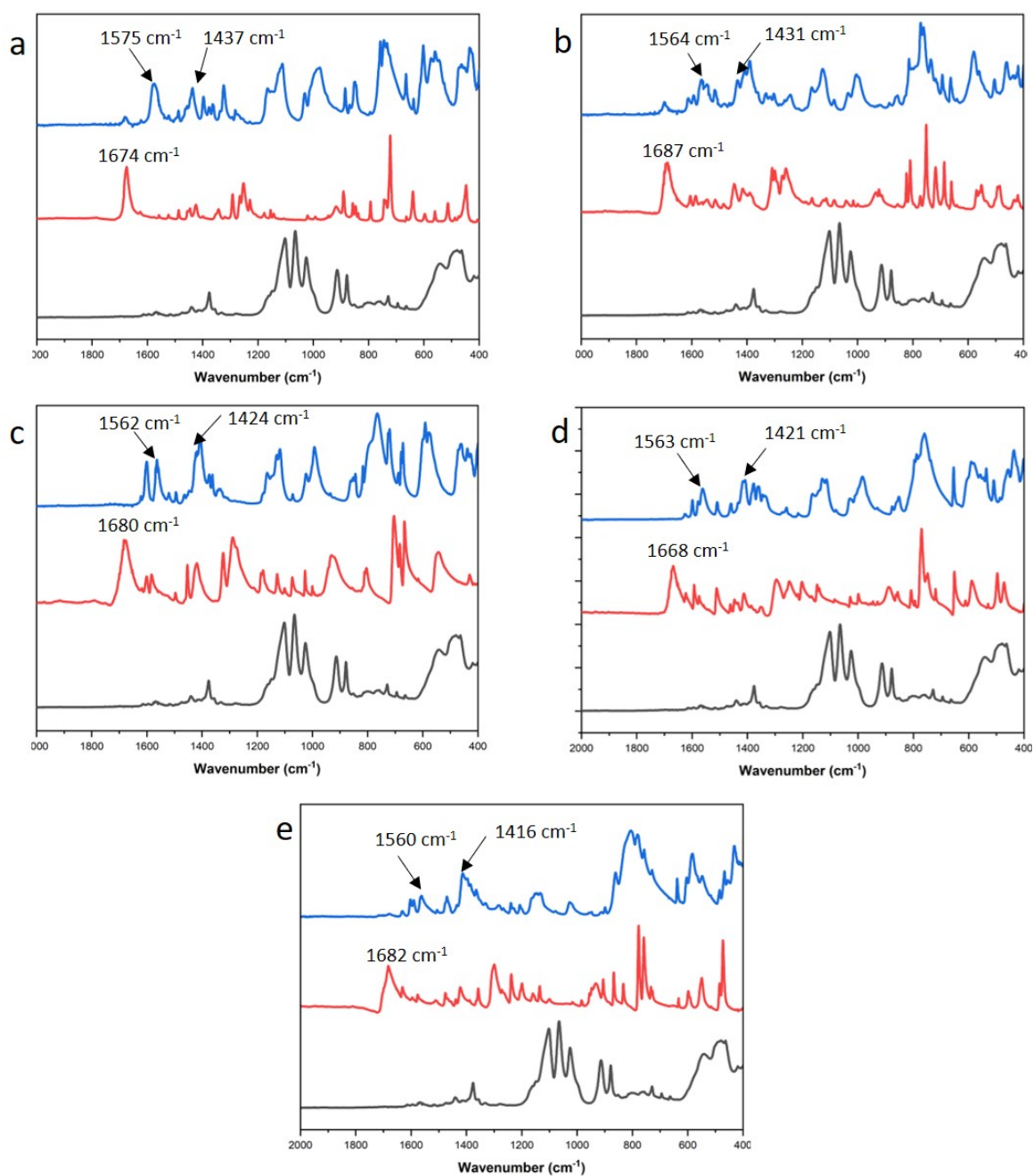


Figure S3b. Infrared spectroscopy analysis in the 2000 – 400 cm^{-1} range for the tantalum complexes **1** (a), **2** (b), **3** (c), **4** (d), **5** (e) (blue lines). The free ligands anthracene-9-carboxylic acid (a), 4'-methylbiphenyl-4-carboxylic acid (b), benzoic acid (c), 1-naphtioic acid (d) and 2-naphtioic acid (e) (red lines) and the tantalum precursor $\text{Ta}(\text{OEt})_5$ (black lines).

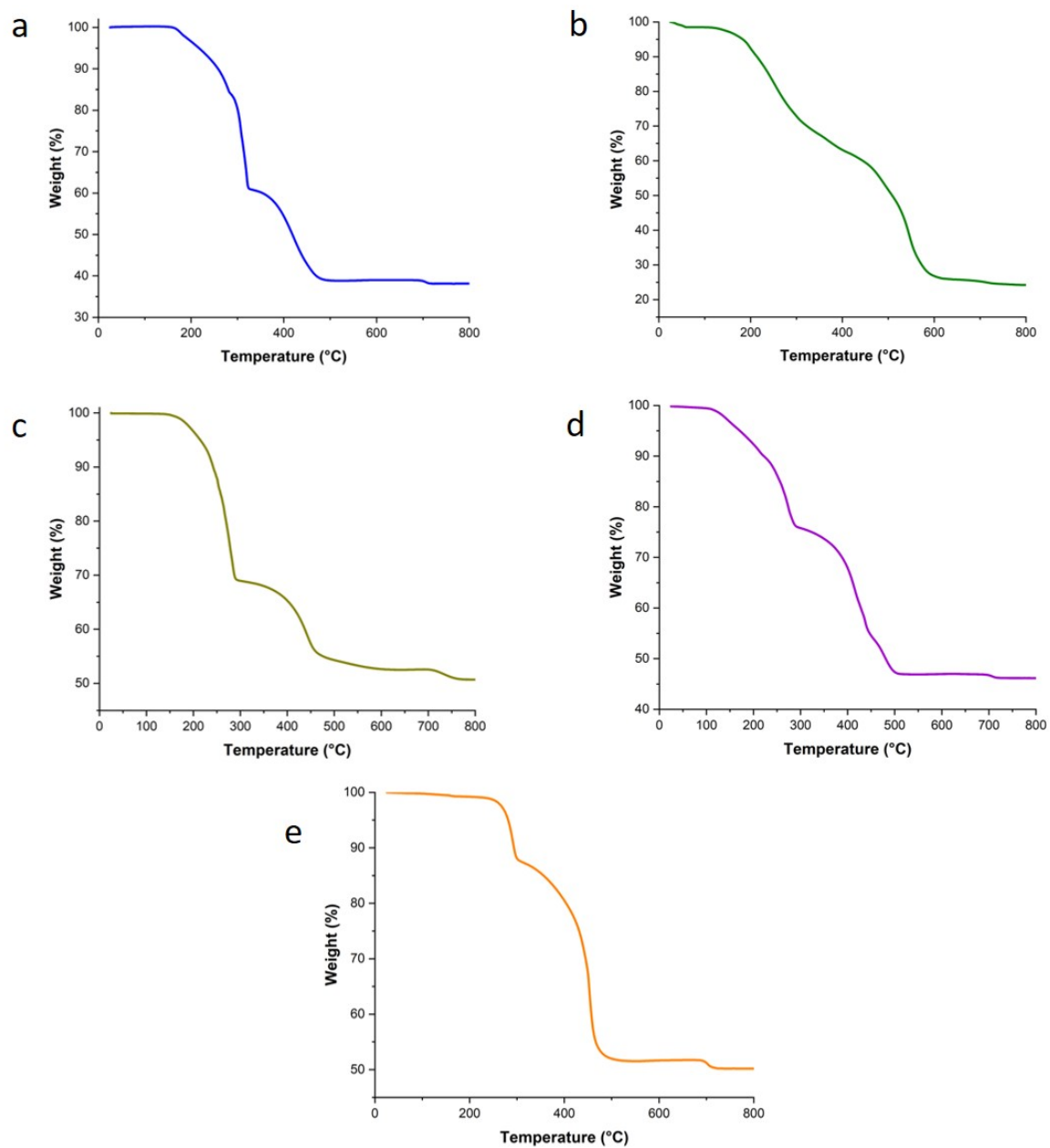


Figure S4. TGA of the tantalum complexes **1** (a), **2** (b), **3** (c), **4** (d), **5** (e).

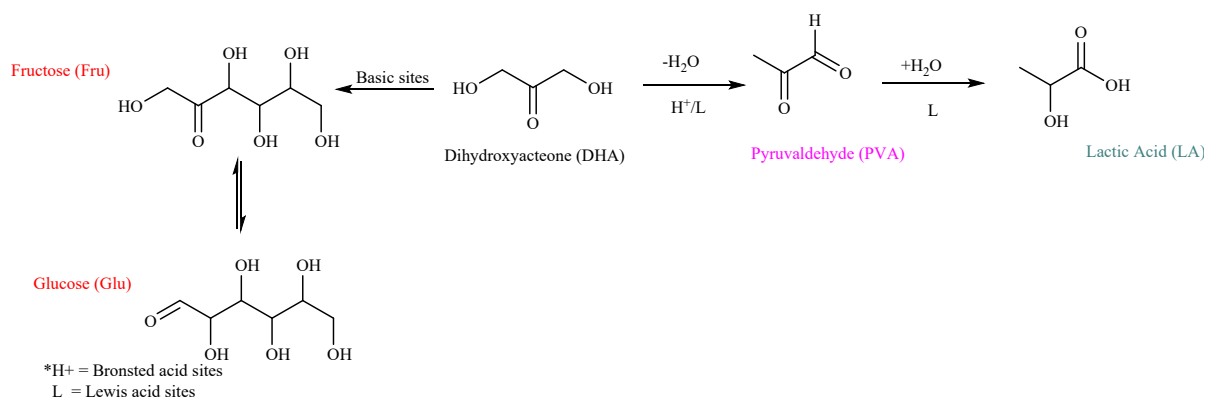


Figure S5. Catalytic reaction scheme of the conversion of dihydroxyacetone (DHA) into lactic acid (LA), pyruvaldehyde (PA) and sugars (C_6 , such as glucose or fructose).