

705 **9 Supporting information**

Table S1: Uranium dioxide powder analysis.

Physical properties	
Measured data	Value
Apparent density	$2.17 \times 10^3 \text{ kg m}^{-2}$
Castability	25.5 g s^{-1}
Grain size ($< 100 \mu\text{m}$)	99.8 %
Grain size ($\geq 100 \mu\text{m}, \leq 200 \mu\text{m}$)	0.2 %
Grain size ($> 200 \mu\text{m}$)	0.0 %
Mechanical resistance	570 N
Specific surface area	$2.98 \text{ m}^2 \text{ g}^{-1}$
Sintered density	97.28 % d_{th}
Tap density	$2.71 \times 10^3 \text{ kg m}^{-2}$
Thermal stability	0.857 % d_{th}

Chemical composition	
Measured data	Value
Oxygen stoichiometry	2.06
Uranium content	87.80 %
Water content	$728 \mu\text{g g}^{-1}$

Uranium isotopic composition	
Measured data	Value
Uranium 234	0.0011 %
Uranium 235	0.2576 %
Uranium 236	$\leq 0.0003 \%$
Uranium 238	99.7410 %

Impurities

Measured data	Value	Measured data	Value
Aluminium	$< 1 \mu\text{g g}_U^{-1}$	Magnesium	$< 1 \mu\text{g g}_U^{-1}$
Bismuth	$< 1 \mu\text{g g}_U^{-1}$	Manganese	$\leq 1 \mu\text{g g}_U^{-1}$
Boron	$< 0.2 \mu\text{g g}_U^{-1}$	Molybdenum	$< 1 \mu\text{g g}_U^{-1}$
Carbon	$18 \mu\text{g g}_U^{-1}$	Nickel	$4 \mu\text{g g}_U^{-1}$
Calcium	$2 \mu\text{g g}_U^{-1}$	Niobium	$< 0.2 \mu\text{g g}_U^{-1}$
Cadmium	$< 0.2 \mu\text{g g}_U^{-1}$	Nitrogen (combined)	$< 10 \mu\text{g g}_U^{-1}$
Chlorine	$< 10 \mu\text{g g}_U^{-1}$	Phosphorus	$< 10 \mu\text{g g}_U^{-1}$
Chromium	$< 2 \mu\text{g g}_U^{-1}$	Samarium	$< 0.1 \mu\text{g g}_U^{-1}$
Cobalt	$< 1 \mu\text{g g}_U^{-1}$	Silicon	$3 \mu\text{g g}_U^{-1}$
Copper	$< 5 \mu\text{g g}_U^{-1}$	Silver	$< 2 \mu\text{g g}_U^{-1}$
Dysprosium	$< 0.1 \mu\text{g g}_U^{-1}$	Sodium	$< 1 \mu\text{g g}_U^{-1}$
Europium	$< 0.1 \mu\text{g g}_U^{-1}$	Stain	$< 1 \mu\text{g g}_U^{-1}$
Fluorine	$\leq 10 \mu\text{g g}_U^{-1}$	Tantalum	$< 0.2 \mu\text{g g}_U^{-1}$
Gadolinium	$< 0.1 \mu\text{g g}_U^{-1}$	Thorium	$< 1 \mu\text{g g}_U^{-1}$
Indium	$< 1 \mu\text{g g}_U^{-1}$	Titanium	$\leq 2 \mu\text{g g}_U^{-1}$
Iron	$< 5 \mu\text{g g}_U^{-1}$	Tungsten	$< 0.5 \mu\text{g g}_U^{-1}$
Lead	$< 4 \mu\text{g g}_U^{-1}$	Vanadium	$< 1 \mu\text{g g}_U^{-1}$
Lithium	$< 0.2 \mu\text{g g}_U^{-1}$	Zinc	$< 1 \mu\text{g g}_U^{-1}$
Sum of the impurities		$< 100.9 \mu\text{g g}_U^{-1}$	
Sum of the rare earths		$< 0.4 \mu\text{g g}_U^{-1}$	

Table S2: Uranium dioxide pellets manufacturing conditions.

Pressing

Measured data	Value
Pressure	518 MPa
Mass	0.648 g
Diameter	5.03 mm
Height	5.29 mm
Density	$6.16 \times 10^3 \text{ kg m}^{-2}$
Percentage of theoretical density	56.3 %d _{th}

Sintering

Measured data	Value
Plateau temperature	1100 °C
Plateau duration	4 h
Atmosphere	Ar - H ₂ 4 %
Mass	0.642 g
Diameter	4.66 mm
Height	4.96 mm
Density	$7.59 \times 10^3 \text{ kg m}^{-2}$
Percentage of theoretical density	69.3 %d _{th}