

Supplementary data

Focused Radiation Heating for Controlled High temperature Chemistry, exemplified with the Preparation of Vanadium Nitride Nanoparticles

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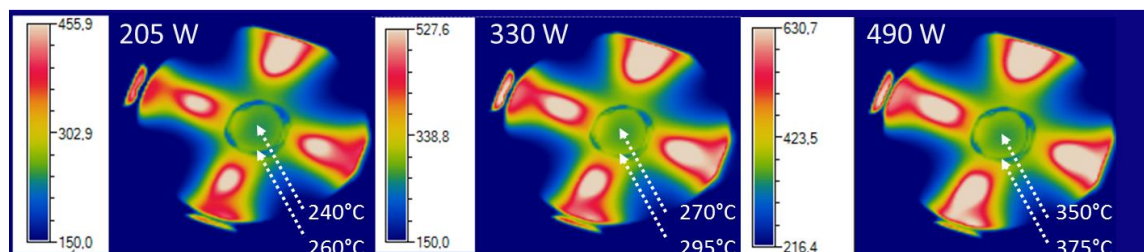


Fig. 1: IR images obtained for different applied powers with the modified glass frit. A Inconel wire rolled as a ring is placed at the center position to represent the crucible position. The emissivity values of the Inconel wire are smaller than the one of silicon carbide resulting in an apparently colder ring.

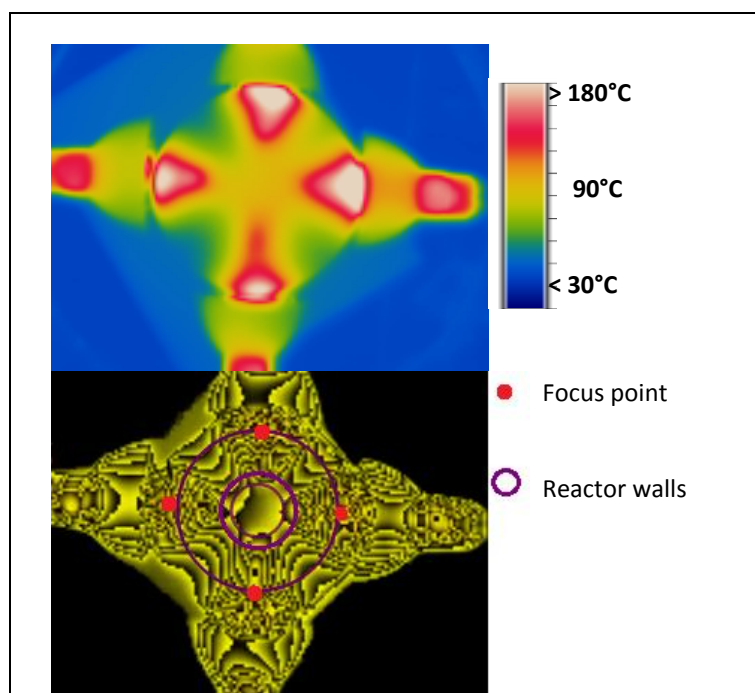


Fig. 2: IR image obtained for an applied power of 252 W with the non modified glass frit. Below, a picture shows the distribution of the various isothermal areas (black –yellow alternate regions).

R (Urea:V)	Elemental analysis wt%			
	5 min		30 min	
	N	C	N	C
3	8,8	1,5	8,8	1,6
5	13,4	9,7	12,4	8,7
7	15,9	5,5	13,7	9,3
	nanoparticles size estimated mean diameter range (in nm)			
3	1	to 5	5	to 12
5	2	to 15	10	to 15
7	2	to 7	7	to 25

Fig. 3: Elemental analysis and mean size diameter (extracted from TEM pictures) of vanadium nitride nanoparticles prepared with various ratio R (Urea:V) and different reaction times (30 min and 5 min)

Reaction temperature	Elemental analysis wt%		Estimated mean diameter range (in nm)	
	N	C		
750 °C	12,4	8,7	10	to 15
650 °C*	13,3	10,6	8	to 16
550 °C*	9	9,5	2	to 10

*Vanadium oxide needles observed (length: 100 to 500 nm)

Fig. 4: Elemental analysis and mean size diameter (extracted from TEM pictures) of vanadium nitride nanoparticles prepared under various reaction temperatures

Heating rates (in K.min ⁻¹)	Reaction time (in min)	Elemental analysis wt%		Estimated mean diameter range (in nm)	
		N	C		
100	30	10,75	8,15	1	to 4
	5*	11,05	8,25	10	to 22
50	30	8,8	1,5	5	to 12
	5	8,8	1,55	1	to 10

* mean diameter of aggregates and not single particles that must be smaller than 4 nm

Fig. 5: Elemental analysis and mean size diameter (extracted from TEM pictures) of vanadium nitride nanoparticles prepared under various heating rate preparation conditions