

I.FAST Project

OBJECTIVES

NANOKER'S MAIN OBJECTIVES

Task 4.4. Large Scale Carbide-Carbon Materials for Multipurpose Applications

- Increasing the maximum achievable volume of CCM components
- Reduce the final productions costs

STRATEGIES

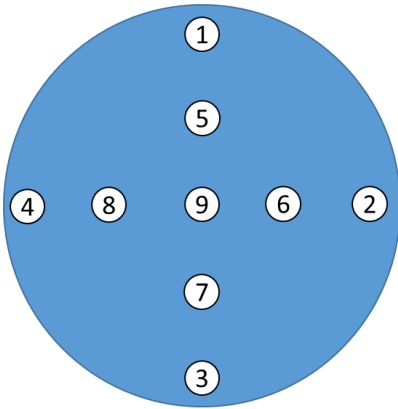
- Up-scale of Disks production up to 230 mm diameter
- Double production per cycle
- Reuse of graphite parts

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Molybdenum - Graphite

Up-Scale to 230 mm Diameter

Batch 984: 2640 °C 26MPa 20 min + Annealing 2400 °C 3h



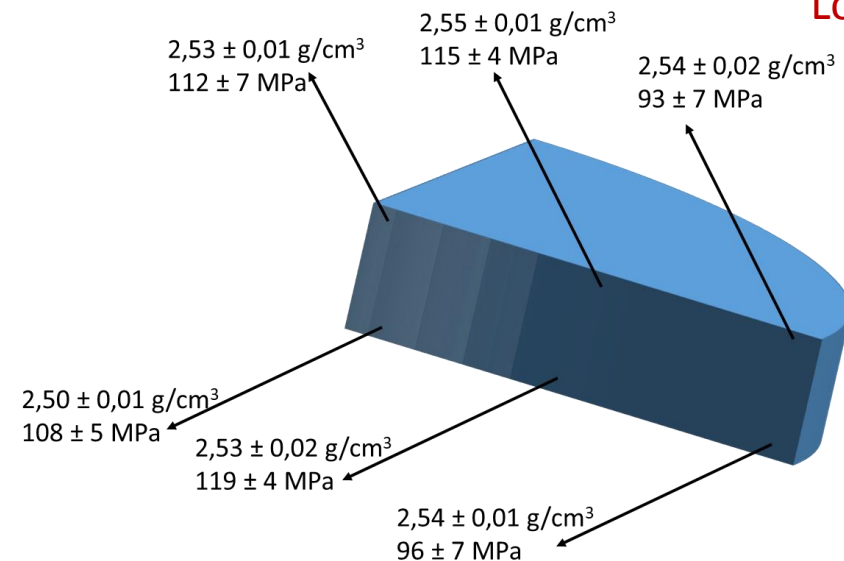
Disk (230 mm diameter)	Density (g/cm ³)	Electrical Conductivity (Mean values on each side) (MS/m)
Green Compact	1,65	-
After Sintering	2,53	0,57 – 0,58
After Annealing	2,53	0,6 – 0,63

Lower electrical conductivity values than in the 174 mm diameter disks

Pre-compaction of the green powder:

Maximum Applied Force Uniaxial Hydraulic Press ~ 900 kN

- 170 mm Ø → 40 MPa → 2,00 g/cm³
- 230 mm Ø → 21 MPa → 1,65 g/cm³



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Molybdenum - Graphite

Up-Scale to 230 mm Diameter

NEXT TRIALS:

- Increasing the Applied Pressure up to 40 MPa
- Increasing the Metals Concentration (i.e., $1.5 \cdot C_0$) \rightarrow 8,25vol% Mo – 0,9vol% Ti

Based on the results of the two previous tests:

- Up-Scale Production to 2 disks per cycle

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Chromium - Graphite

First Results on 170 mm Diameter Disks

Disk (170 mm diameter)	Density (g/cm ³)	Electrical Conductivity (Mean values on each side) (MS/m)
Green Compact	1,90	-
After Sintering	2,36	0,98 – 1,04
After Annealing	2,30	1,00 – 1,07

Batch 1009: 2000 °C 26MPa 20 min + Annealing 1700 °C 3h



Reusable Mold and Parts → Important Cost Reduction

NEXT TRIALS:

- 170 mm diameter 2 disks per cycle
- Up Scale to 230 mm diameter single disk per cycle
- Up Scale to 230 mm diameter double disk in one cycle

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Cost and throughput

Material	Production set-up	Surface available	Throughput*	Price**
MoGr	D170 mm x 2	22,69 cm ²	25 cycles	3050,00 € / block
MoGr	D230 mm x 2	41,54 cm ²	13 cycles	≈ 10 %
CrGr	D170 mm x 2	22,69 cm ²	25 cycles	≈ 20 %
CrGr	D230 mm x 2	41,54 cm ²	13 cycles	≈ 30 %

* Measured based on the cycles needed to produce 100 blocks type 1

** The calculation of the price reduction should be confirmed after testing