

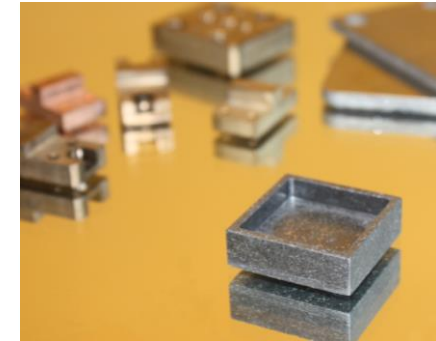



# EUCARD/EUCARDII highly conductive material contributions

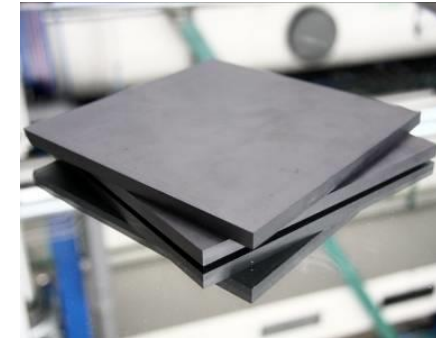
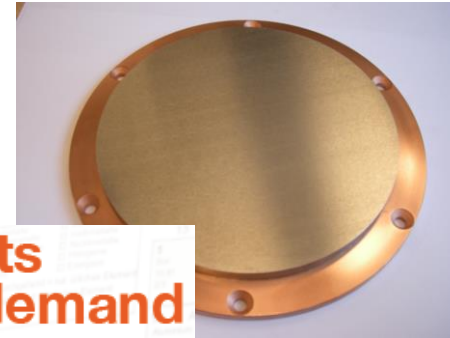
RHP-Technology GmbH  
A-2444 Seibersdorf, Austria




 **Advanced Materials** for Thermal Management



 Development and Manufacturing of **Sputtering Targets** with customized composition

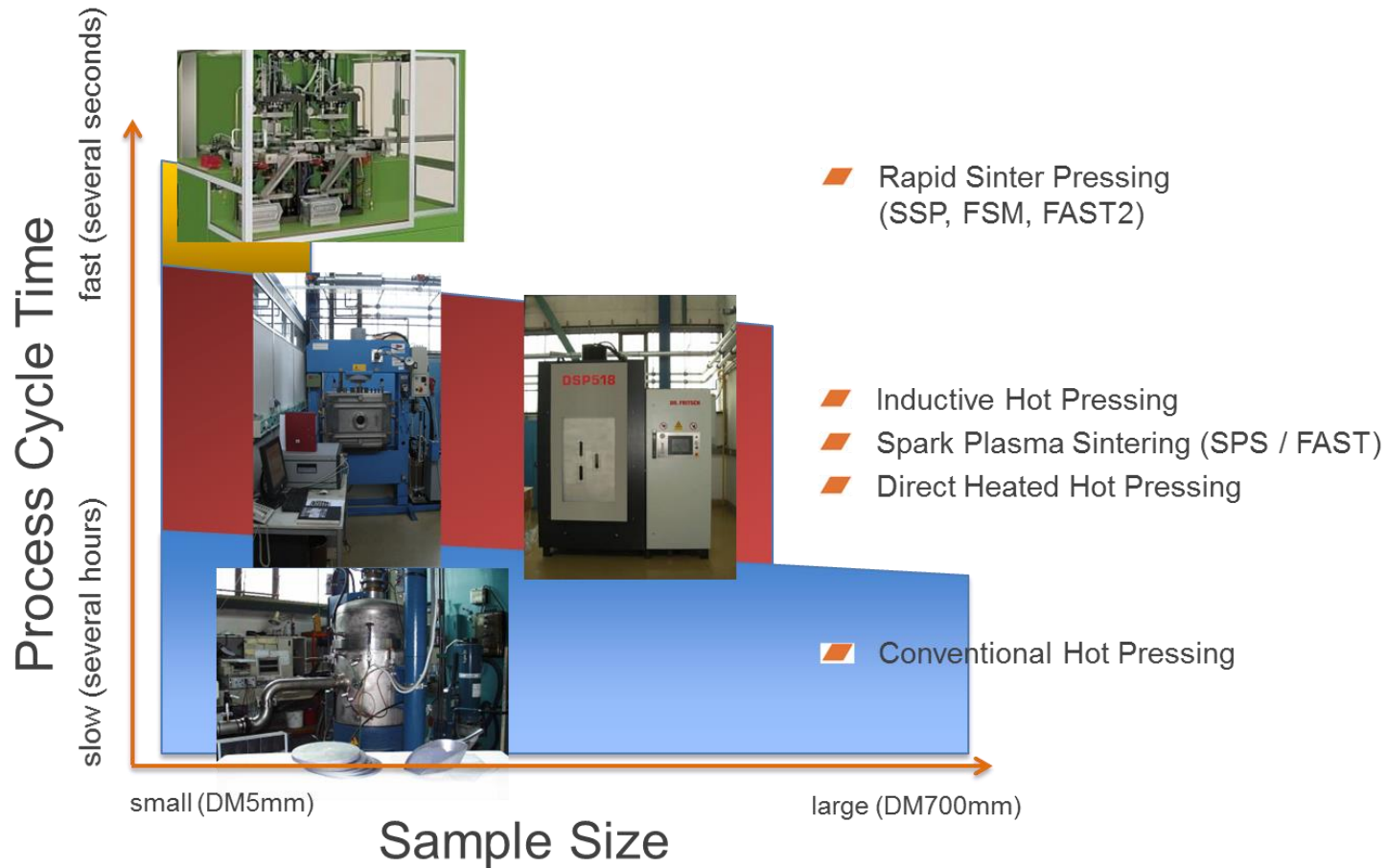


 **Research Solutions** in powder technology, hot pressing, sintering Powder Injection Moulding



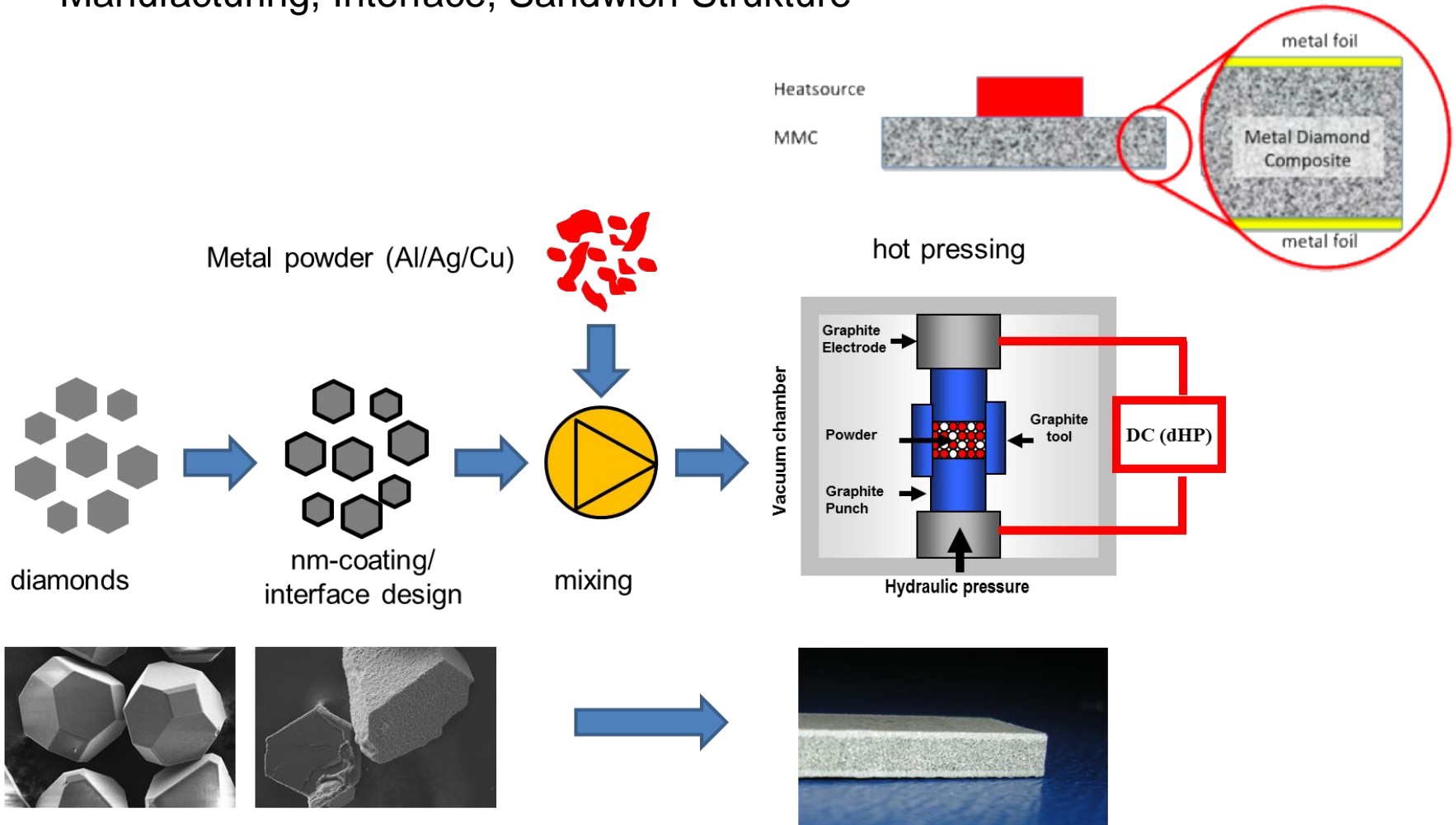
# Hot Pressing Technologies at RHP

from hours to seconds



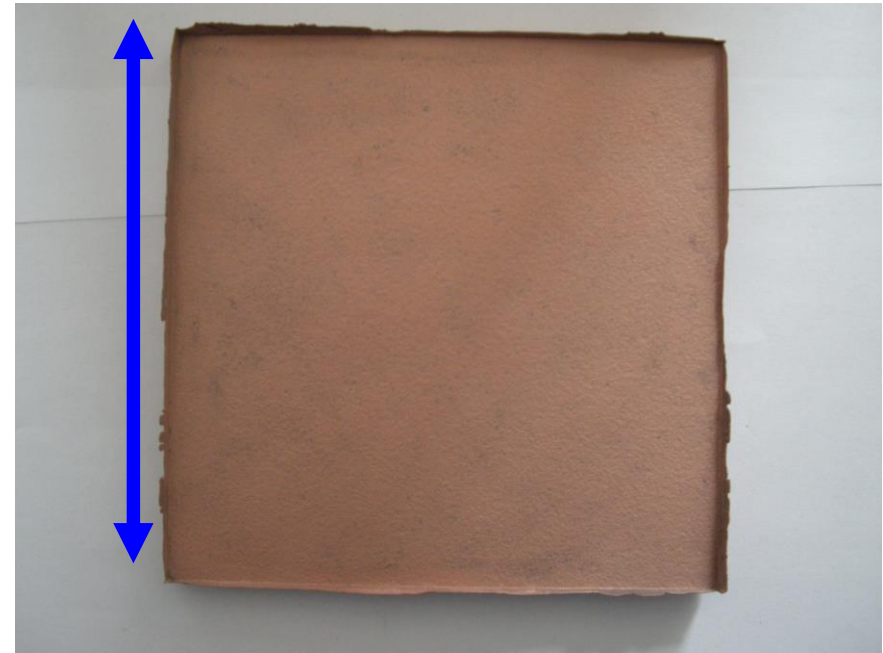
# Metal – Diamond Composite

## Manufacturing, Interface, Sandwich Structure



# CuCD by Conventional and Direct Hot Pressing

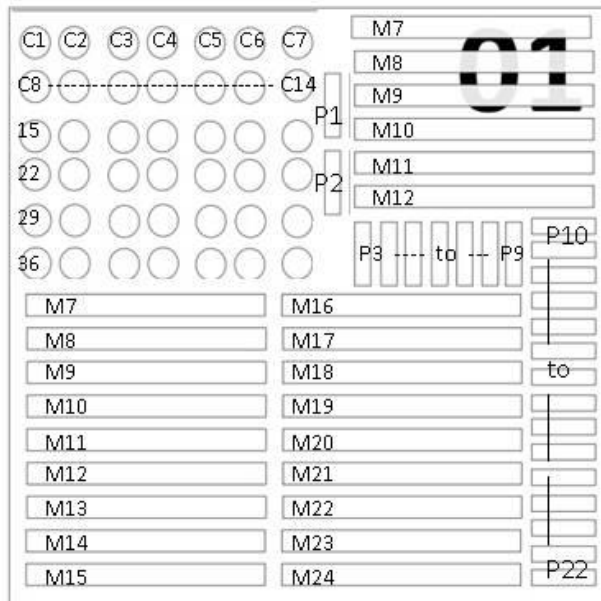
- Manufacturing of Cu-diamond plates with 60 vol.%
- Water jet cutting of samples for:
  - Thermal Diffusivity
  - CTE
  - Mechanical Testing
  - Measurement of mechanical properties at high temperature
- Measurement of RT thermal diffusivity of 40 samples: 218 +/- 18 mm<sup>2</sup>/s
- Measurement of CTE on 5 samples: CTE ~6 ppm/K at 100° C.



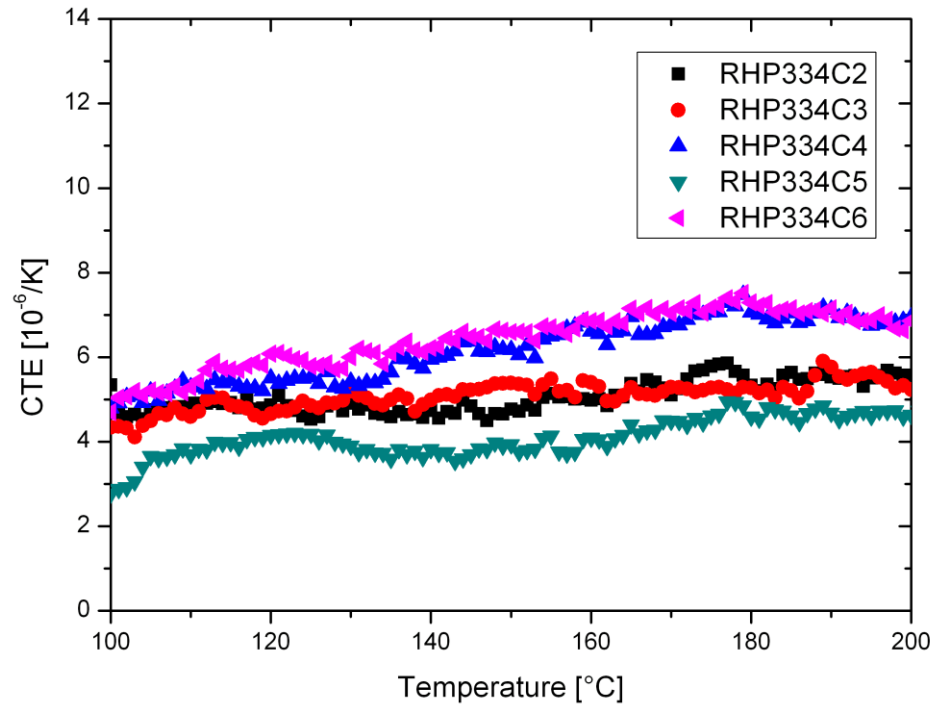
**150 mm x 150 mm**

# Internship of N. Mariani @ RHP

- Manufacturing and Characterization of Samples
- Different sample geometries were cut out of the plates by water jet cutting.

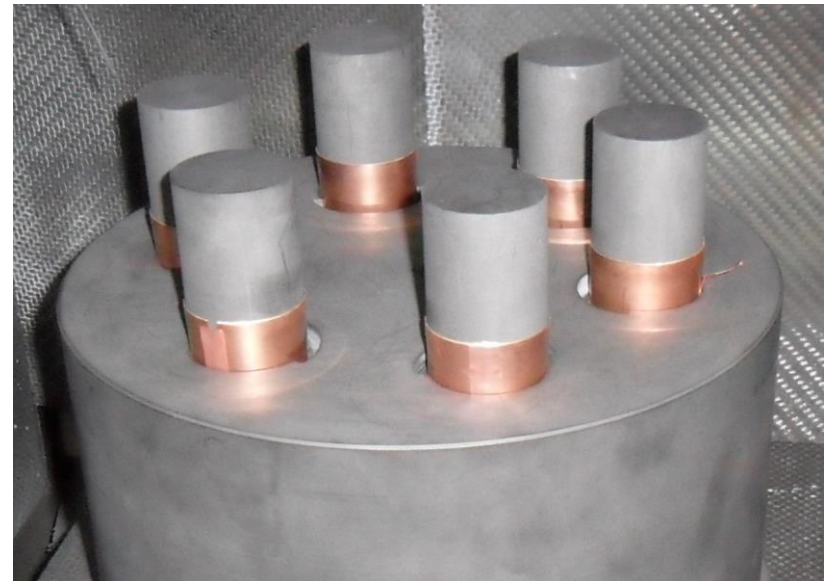


- Measurement of Thermal Expansion Coefficient
- Thermal diffusivity measurements
- Selection of suitable material composition together with CERN for irradiation experiments + testing of properties



# Samples for HIRADMAT experiment

CuCD material manufactured by direct hot pressing





# Demonstrator for middle segment of collimator jaw

CuCD material manufactured by direct hot pressing



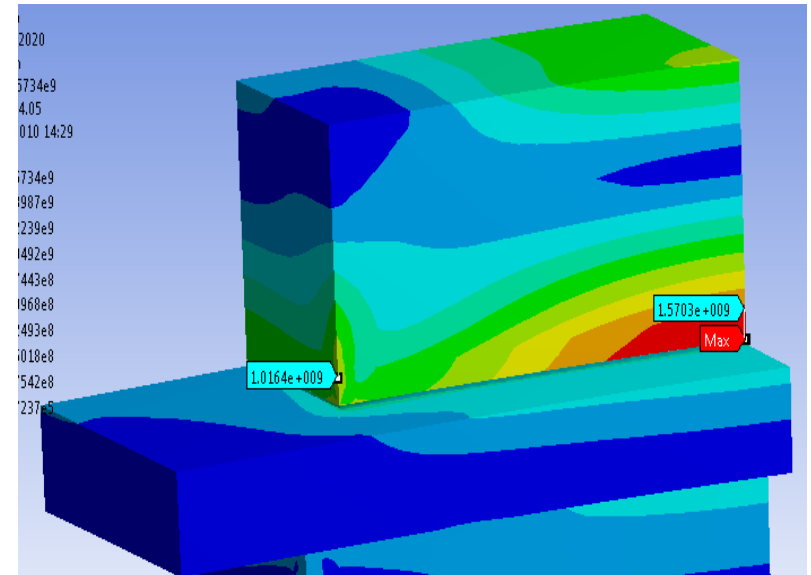
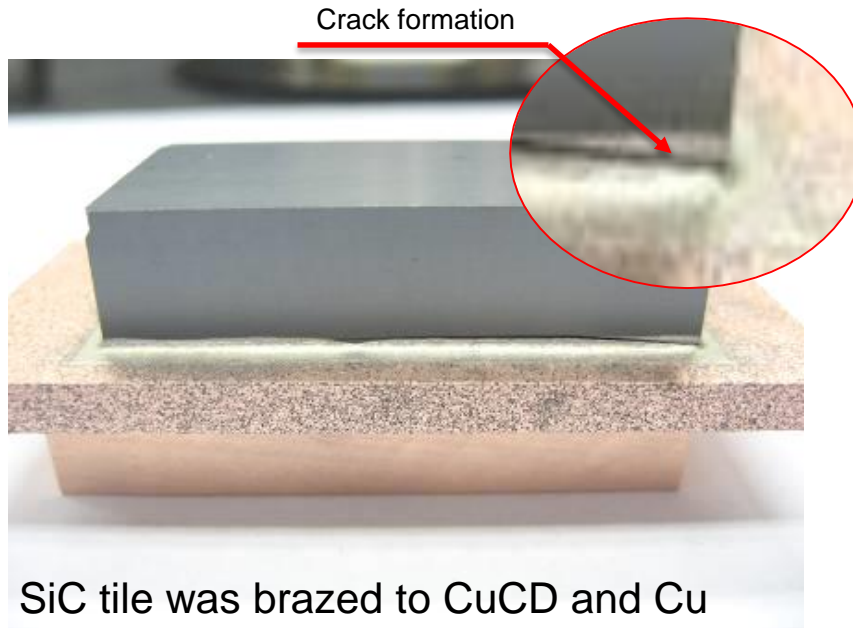
## CuCD Samples for Politecnico di Torino

- Manufacturing of Cu-diamond Samples for Tensile testing
- Shape was cut out of the plate by water jet cutting.



# Brazing of SiC tiles to the collimator jaw material (CERN)

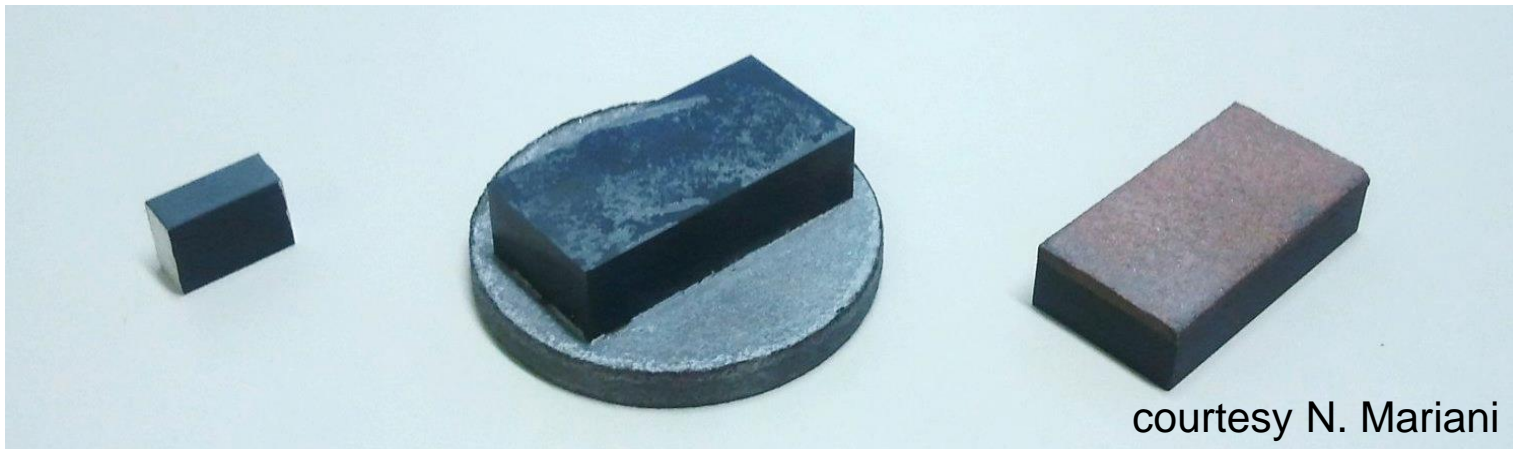
- Cracking of the SiC occurred after brazing process
- Idea to manipulate electrical resistivity of SiC



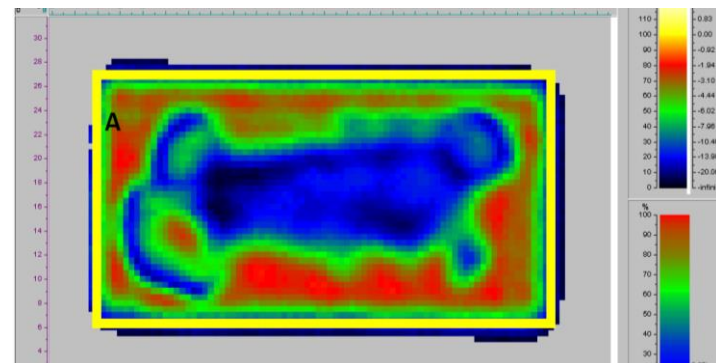
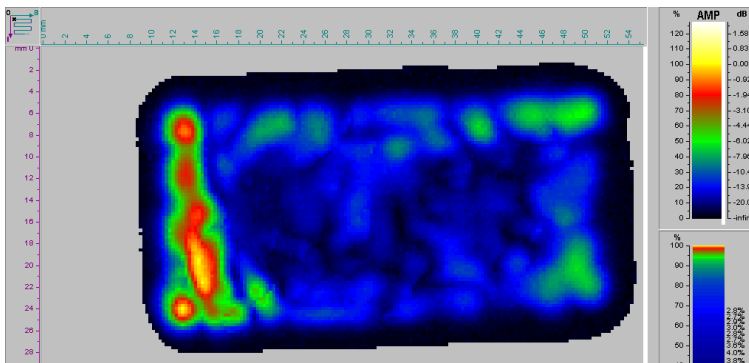
courtesy N. Mariani



- Process development: Direct bonding of SiC tiles to Cu/Diamond using the hot press.
- SiC-C material supply for higher electrical conductivity



courtesy N. Mariani



Supplier and Type of SiC	Boostec	ESK Ekasic T	Keramo	Microcertec Medium Resistivity	RHP Technology SiC-C
Electrical Resistivity ( $\Omega$ .cm)	3629	1081	40741	4687	<b>2980</b>
Standard Deviation	529	32	8260	372	<b>337</b>

## Comparison between various SiC Types and SiC-C from RHP.

To overcome the limitation due to the insulator like electrical behaviour of Microcertec SiC (Electrical Resistivity  $\sim 4700 \Omega$ .cm), RHP Technology produced a new kind of Silicon Carbide having more C than Si (name SiC-C): the addition of the free electrons of the added C atoms should enhance the electrical conductivity of the ceramic reducing its electrical resistivity.

courtesy R. Blanchon, W. Vollenberg, N. Mariani

## Samples for Irradiation Studies at BNL

- Repeating of irradiation experiments at Brookhaven National Laboratory, testing for radiation hardness
- New Samples for BNL – Copper Diamond***
- Water jet cutting with conical correction and manual grinding for a tight fit



courtesy N. Mariani

Samples were delivered to:	Ref. No.	DM 8mm	16x4 mm <sup>2</sup>	5,5x60mm <sup>2</sup>
CERN (to Nicola Mariani)	RHP334	C-17 to C-42	-	-
KI (via CERN/Mariani)	RHP334 RHP412	16 pcs (8mm) 10 pcs (10mm)	P-1 to P-22	M-9 to M-24
GSI (via CERN/Mariani)	RHP334	8 pcs	-	-
RHP	RHP334 HP 1832	C-1 to C-16 C-1 to C42	P-1 to P-22	M-1 to M-8 M-1 to M-24

Samples were delivered to:	Ref. No.			
TURINO (via CERN/Mariani)	RHP 412	5 pcs for tensile testing	-	-
CERN (to Mariani)	HP1902	SiC bonded on Cu/Diamond	SiC-C samples	-

Samples were delivered to:	Ref. No.			
HIRADMAT		Cylinders and Half Cylinders	-	-
BNL		For irradiation experiments	-	-

# RHP-Technology & EUCARDII possible contributions to WP11

- ▀ Presentation of advanced ceramics produced at RHP Technology (WC, MoC, SiC, TiC, etc) with specific focus on highly conductive materials
- ▀ Proposals for new heavy and conductive refractory materials (e.g. WC- or Mo<sub>2</sub>C- based) as an alternative to present tungsten heavy alloys
- ▀ Proposals for other SiC- based materials and their bonding to metallic substrates
- ▀ Type and number of material samples to be produced.

***Further details to be presented and discussed tomorrow.***