Óbudai Egyetem

MFA

mta EK

END OF SEMESTER III PRESENTATION :

Preparation and characterization of nanostructured Oxide Dispersion Strengthened (ODS) steel

Student:

BEN ZINE Haroune Rachid

Supervisors:

Dr. Balazsi Csaba

Dr. Balazsi Katalin

CONTENT:

I. Results Presented during previous Semester

II. Actual Semester work

III. Summary of the actual semester

IV. Plan for future work

I. Results Presented in previous Semester:

- Passing all the subjects successfully
- Participating in ‘’ LA SIXIEME ECOLE SUR LES TECHNIQUES DE CARACTERISATION DES MATERIAUX ‘’ at Mohamed Khider University of Biskra, Algeria by video conference. (Lecture about ODS Steel)
- Participating in Webinar conference about « organizing research work and time »
- Visiting Institute of Materials Science, Slovak Academy of Sciences, Kosice, prof. Jan Dusza
- Attending the Hungarian Microscopy Conference, Siofok, 2016. 05. 19-21
- Preparing 6 alloys; 316L with:

1.	**1 % Y_2O_3 :**	**1200 g**
2.	**0.333 %** of **Y_2O_3**	**1200 g**
3.	**1 %** of **Si_3N_4**	**1200 g**
4.	**0.333 %** of **Si_3N_4**	**1200 g**
5.	**1 %** of **SiC**	**1200 g**
6.	**0.333 %** of **SiC**	**1200 g**

- 1 paper was submitted in August 2016

II. Actual Semester Results:

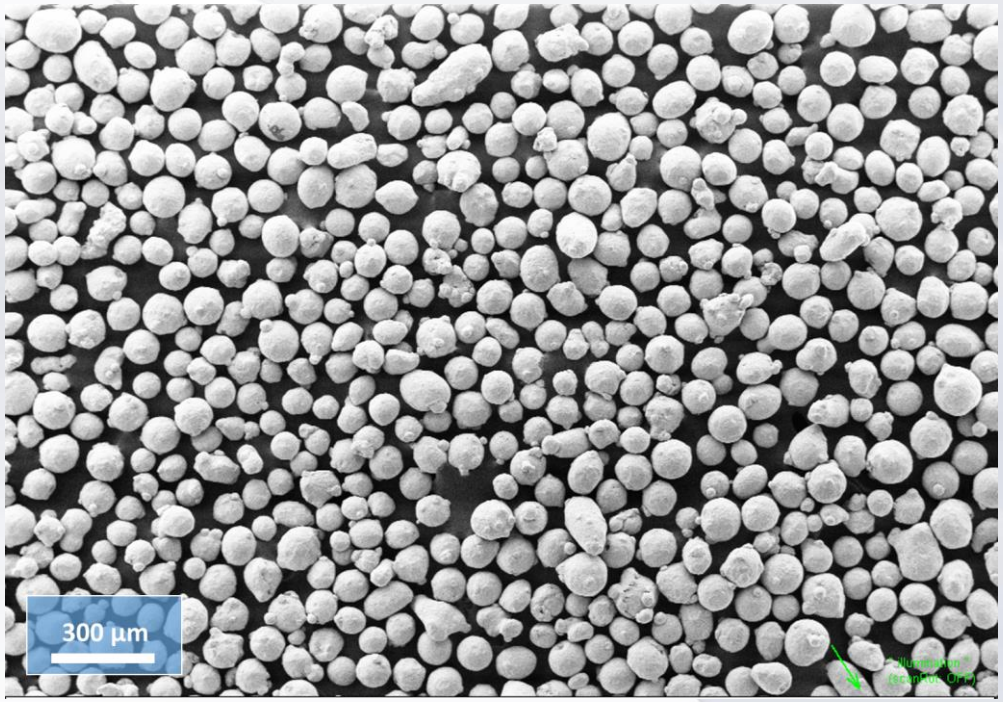
II,1, Continuing with powder preparation (attrition Milling)

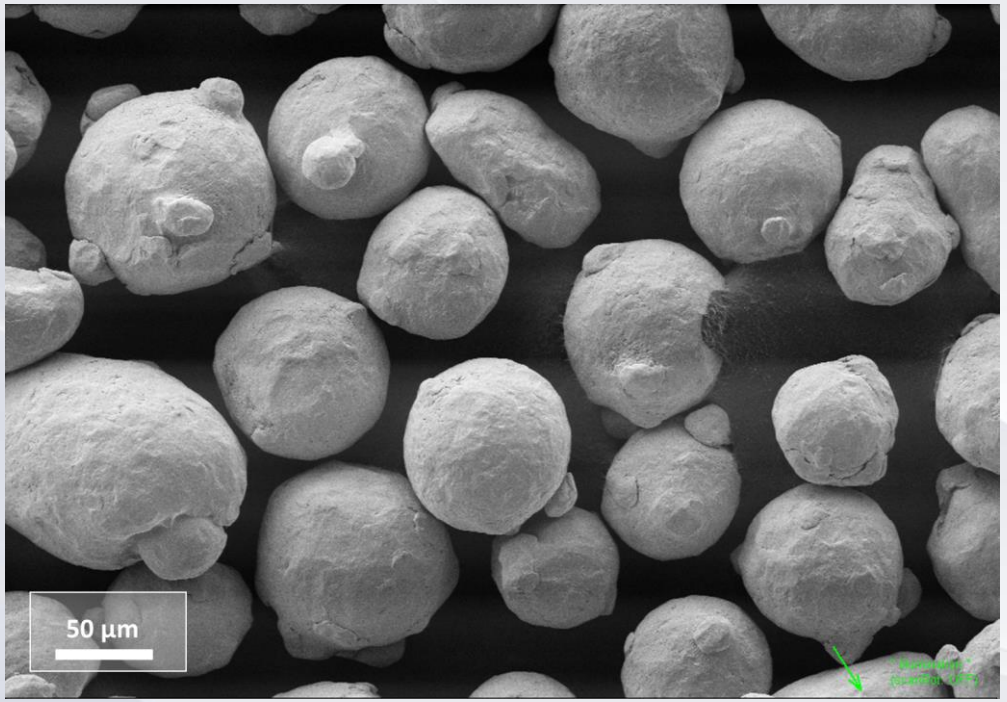
II,1,1, reference powder

II,1,2, 316L+Al2O3 (1 wt % &0,33 wt %)

Nr.	Base powder	addition	Milling speed (rpm)	Milling Time (h)	Quantity (g)
1.	Höganäs 316L	Nothing	600	5	1200
2.	Höganäs 316L	0,33 wt % Al_2O_3	600	5	1200
3.	Höganäs 316L	1 wt % Al_2O_3	600	5	1200

Höganäs 316L Starting Powder:

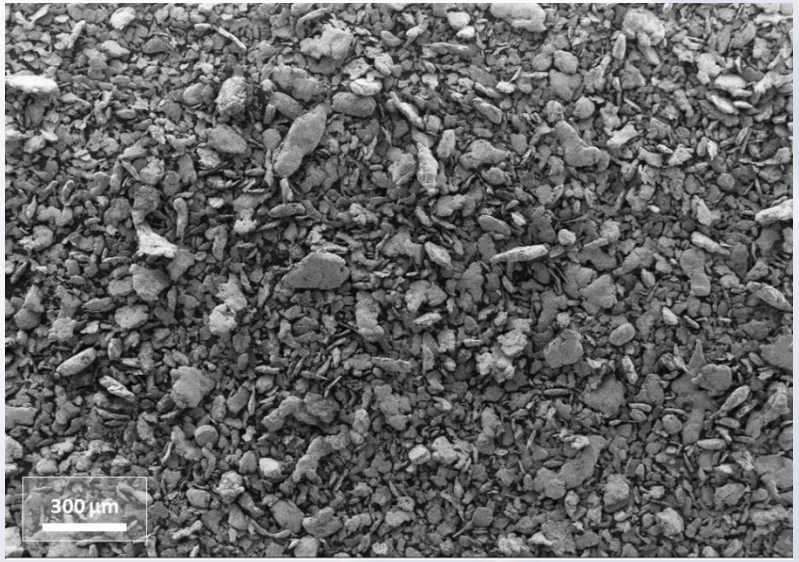


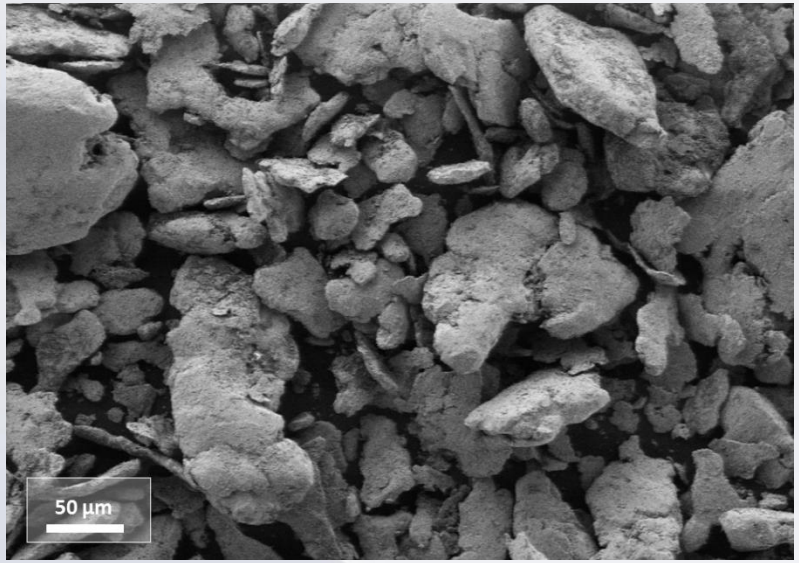


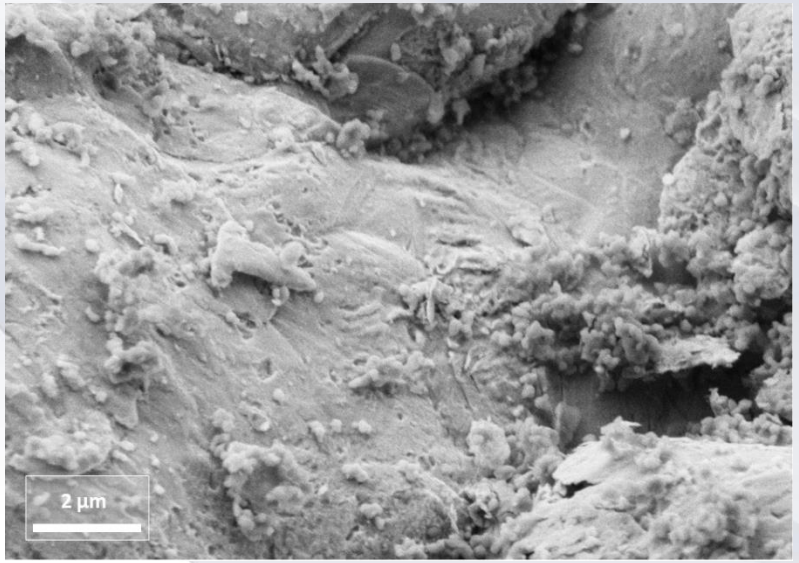
II,2, Characterization of mixed Powders by SEM

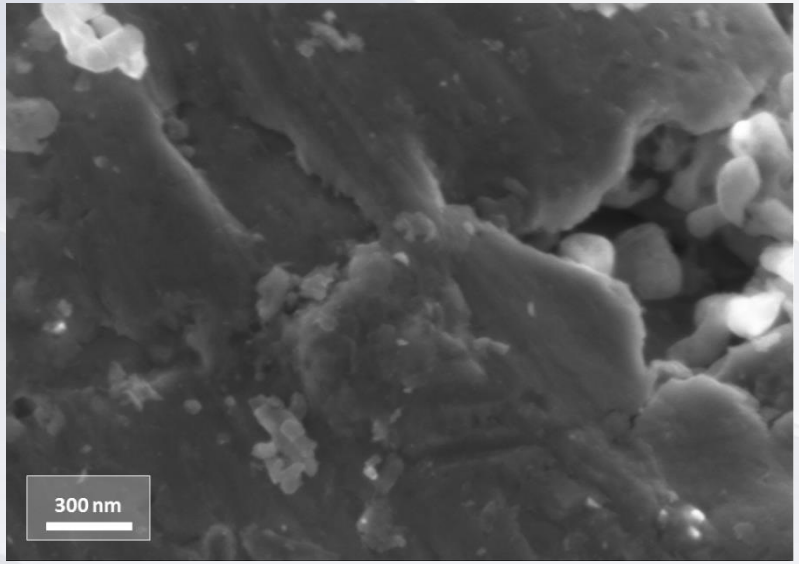
II,2,1, Morphological changes during milling Time using Ball mill:

II,2,1,1: Morphology of the Höganäs 316L after **2h** of Ball Milling





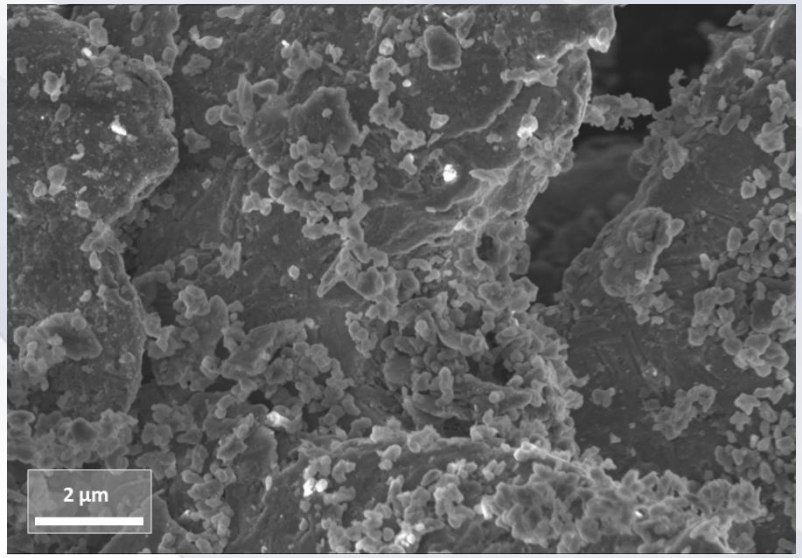


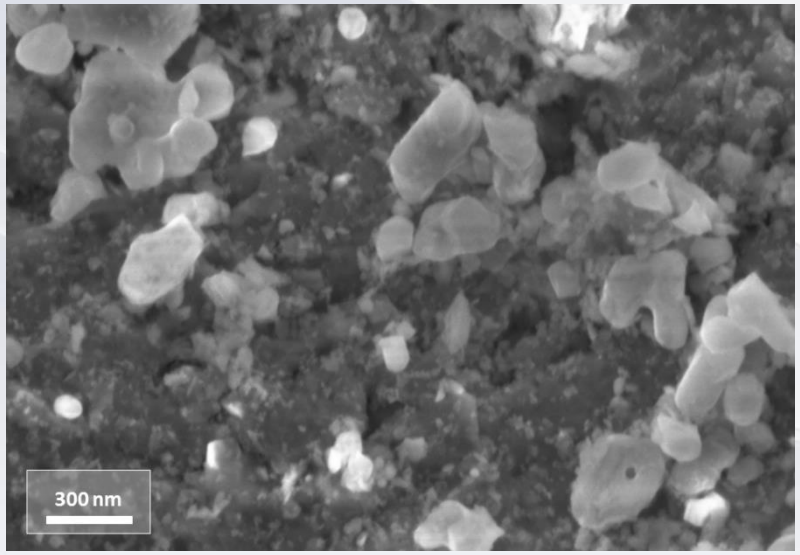


II,2, Characterization of mixed Powders by SEM

II,2,1, Morphological changes during milling Time using Ball mill:

II,2,1,2: Morphology of the Höganäs 316L after **4h** of Ball Milling

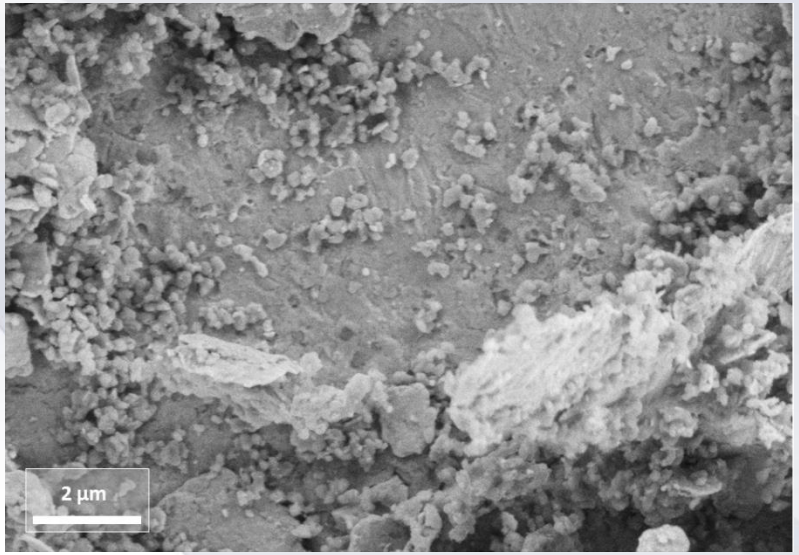


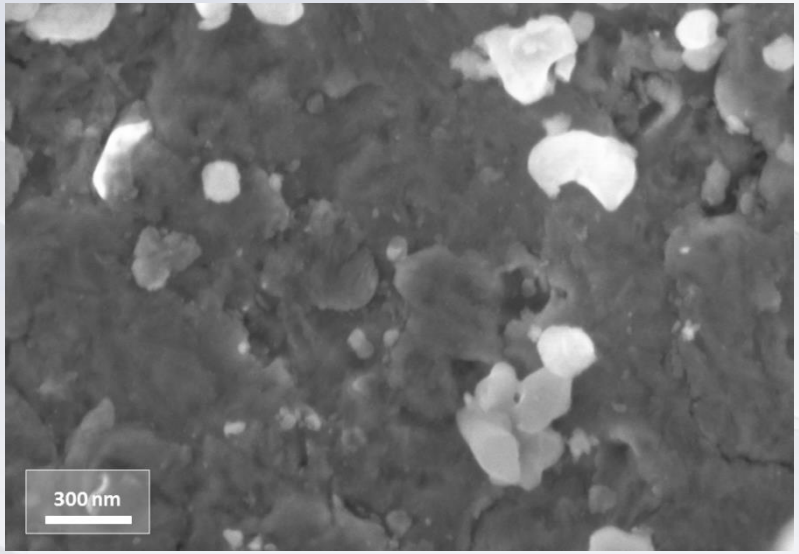


II,2, Characterization of mixed Powders by SEM

II,2,1, Morphological changes during milling Time using Ball mill:

II,2,1,3: Morphology of the Höganäs 316L after **6h** of Ball Milling

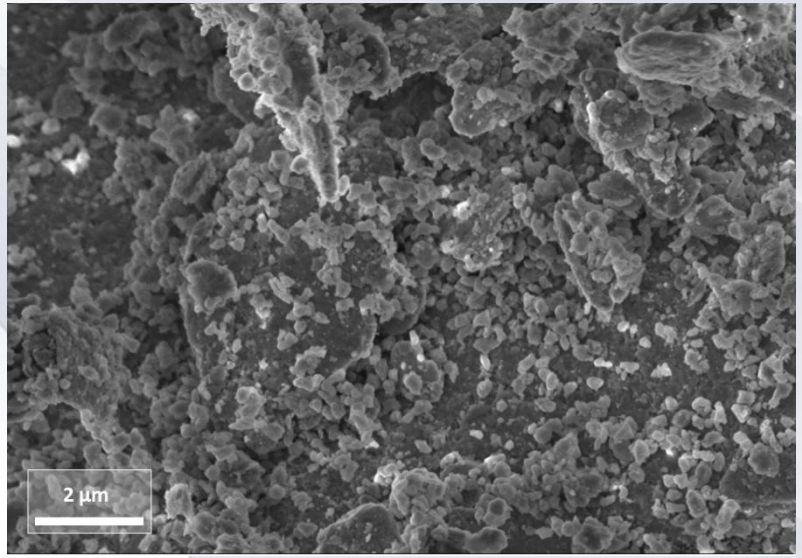


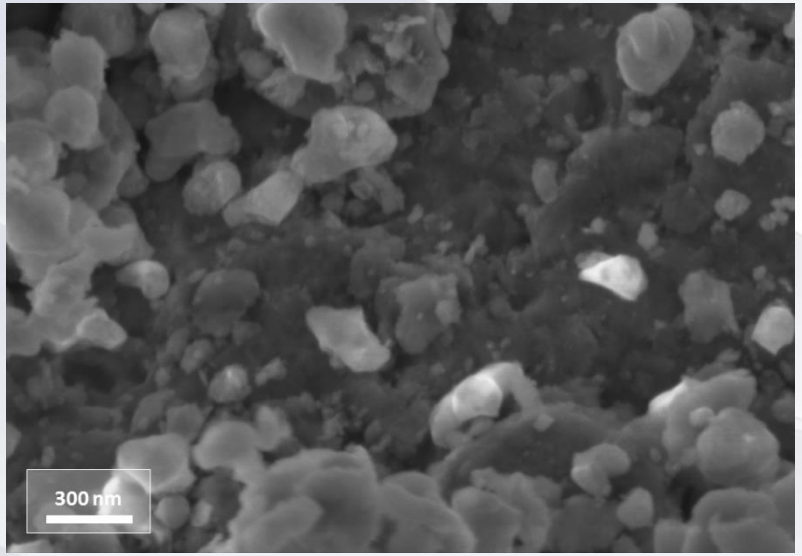


II,2, Characterization of mixed Powders by SEM

II,2,1, Morphological changes during milling Time using Ball mill:

II,2,1,4: Morphology of the Höganäs 316L after **8h** of Ball Milling

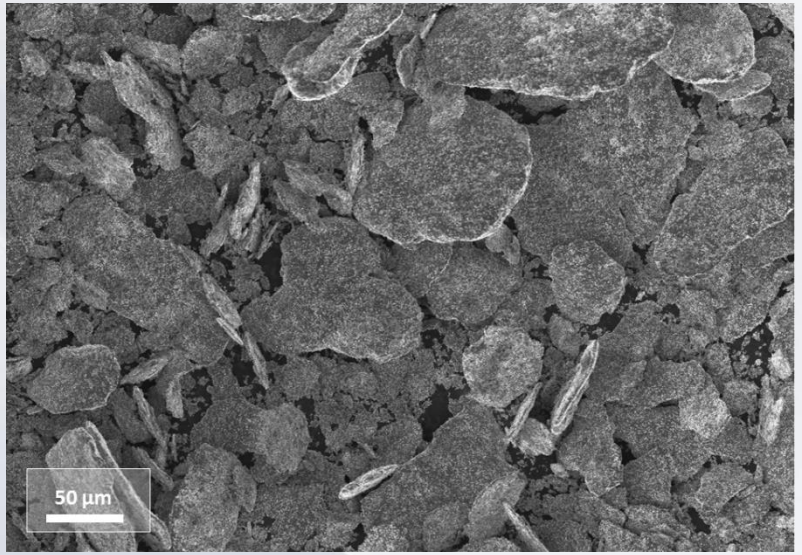


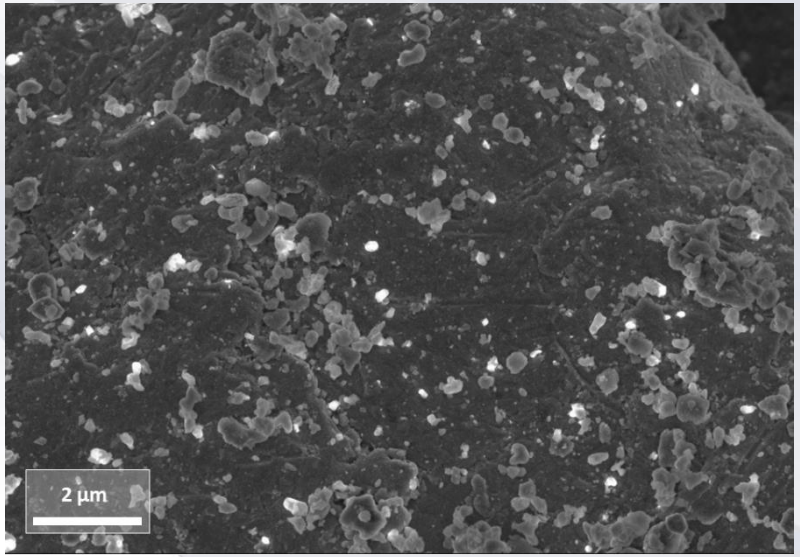


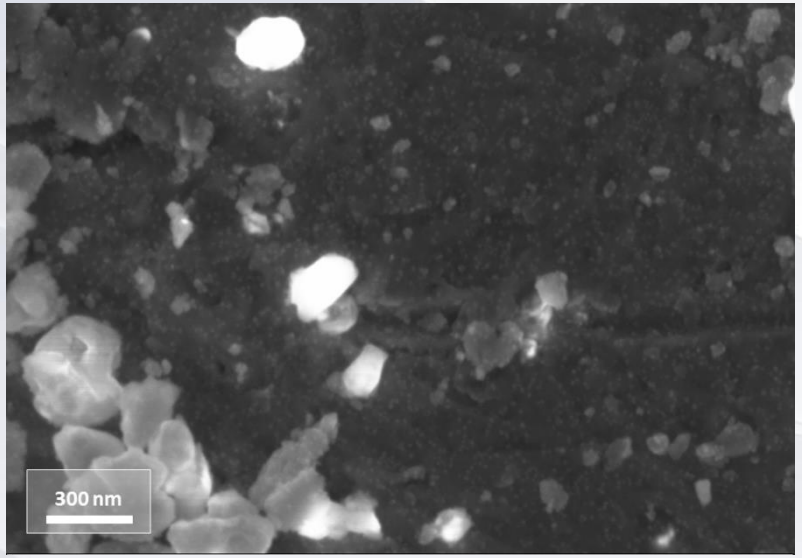
II,2, Characterization of mixed Powders by SEM

II,2,1, Morphological changes during milling Time using Ball mill:

II,2,1,5: Morphology of the Höganäs 316L after **10h** of Ball Milling





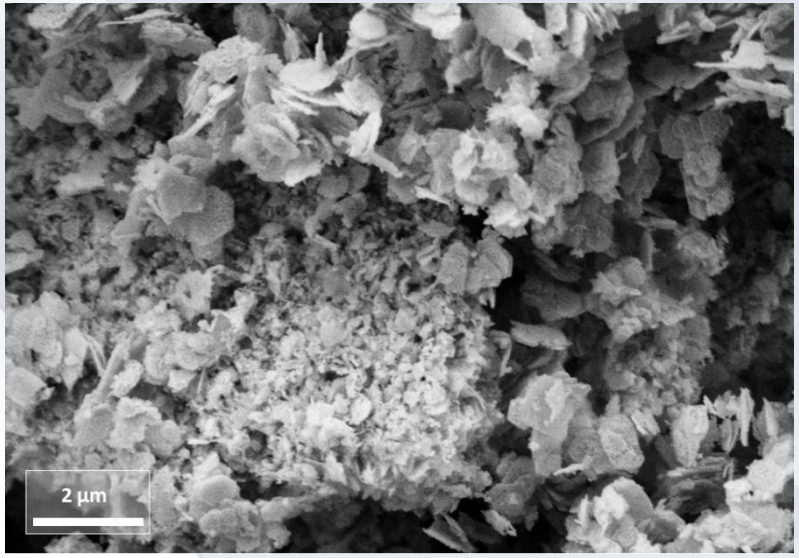


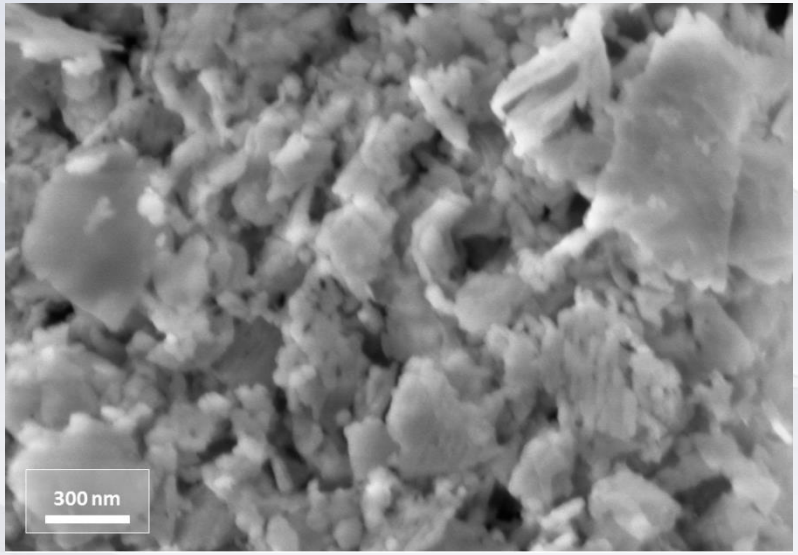
II,2, Characterization of mixed Powders by SEM

II,2,2, Morphological changes during milling Time using attrition milling:

II,2,2, Morphological changes during milling Time using attrition mill:

II,2,2,1: Morphology of the Höganäs 316L after **1h** of attrtion Milling



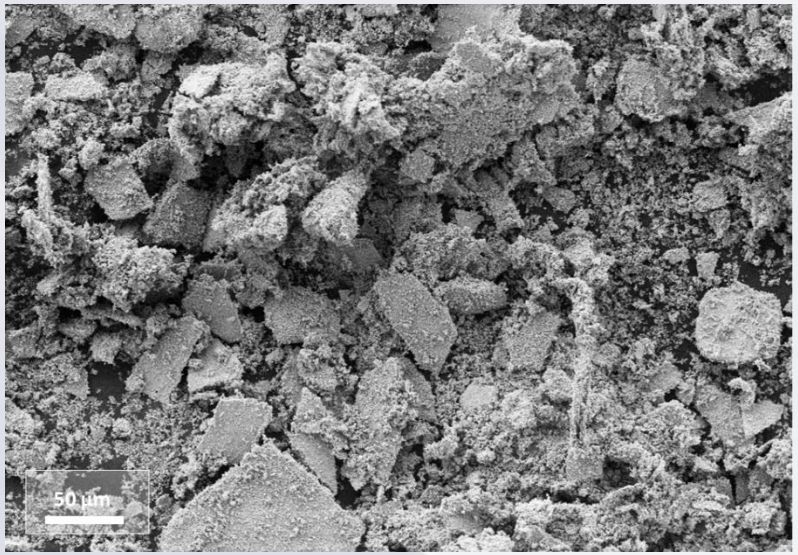


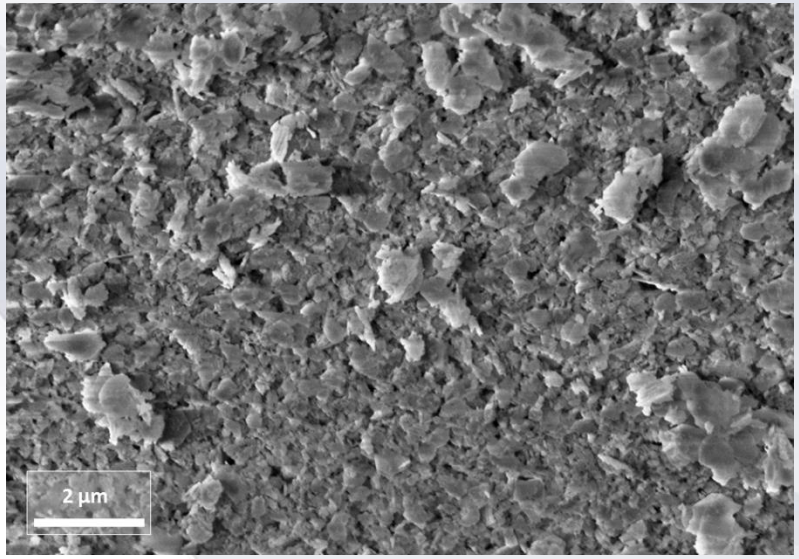
II,2, Characterization of mixed Powders by SEM

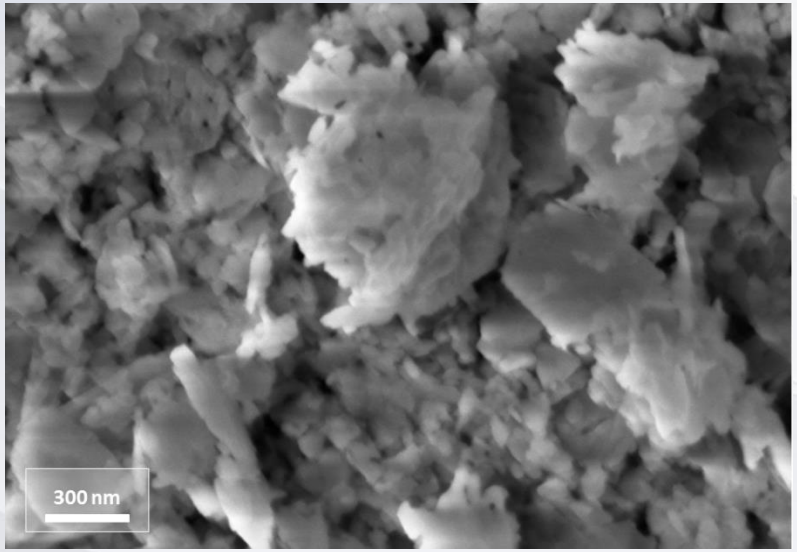
II,2,2, Morphological changes during milling Time using attrition milling:

II,2,2, Morphological changes during milling Time using attrition mill:

II,2,2,2: Morphology of the Höganäs 316L after **2h** of attrtion Milling





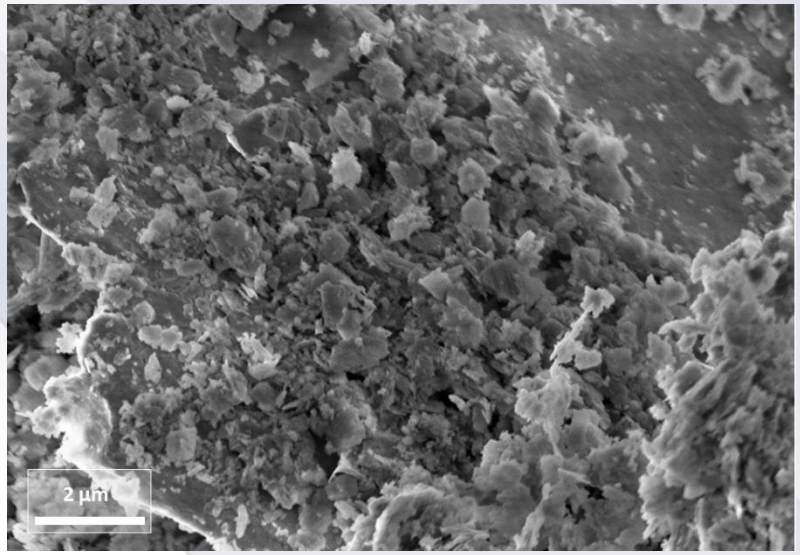


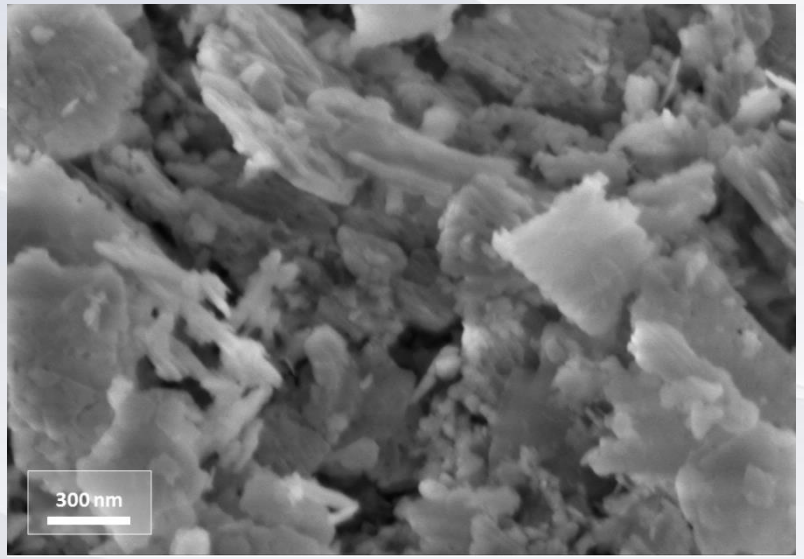
II,2, Characterization of mixed Powders by SEM

II,2,2, Morphological changes during milling Time using attrition milling:

II,2,2, Morphological changes during milling Time using attrition mill:

II,2,2,3: Morphology of the Höganäs 316L after **3h** of attrtion Milling



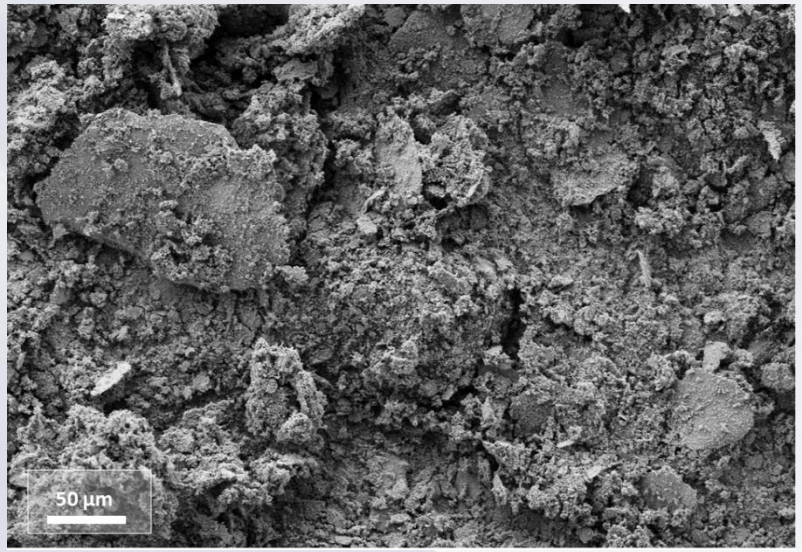


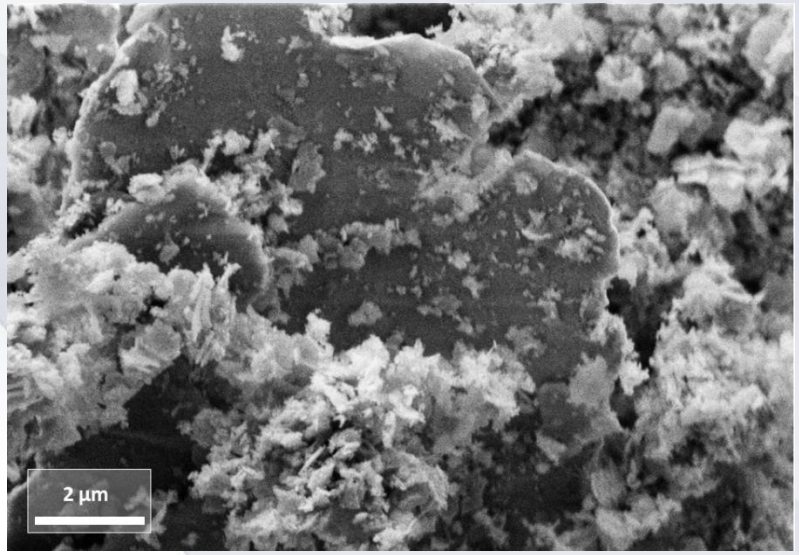
II,2, Characterization of mixed Powders by SEM

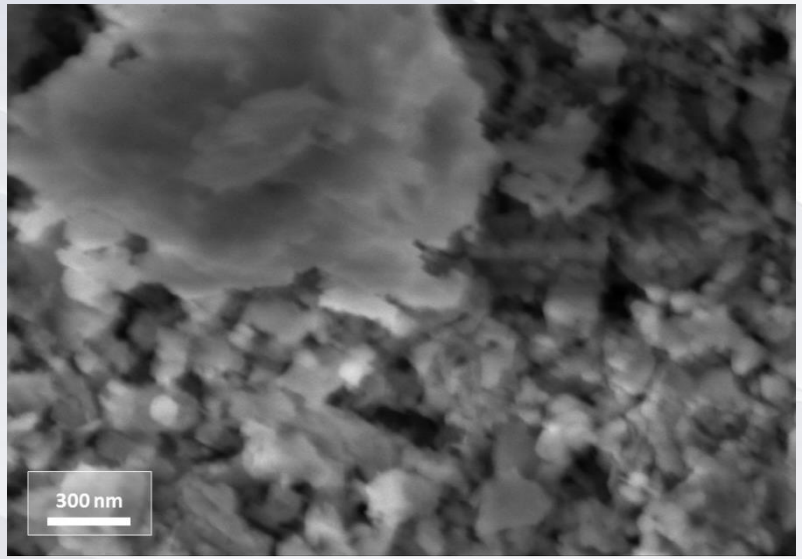
II,2,2, Morphological changes during milling Time using attrition milling:

II,2,2, Morphological changes during milling Time using attrition mill:

II,2,2,4: Morphology of the Höganäs 316L after **4h** of attrtion Milling





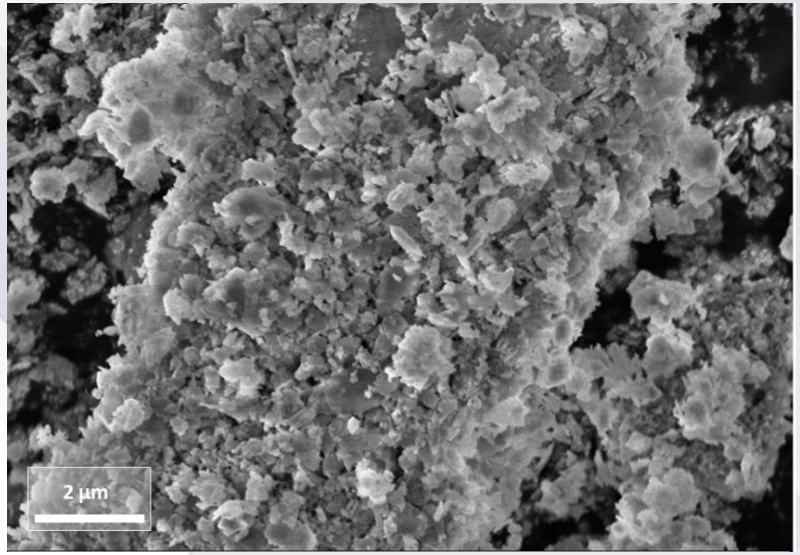


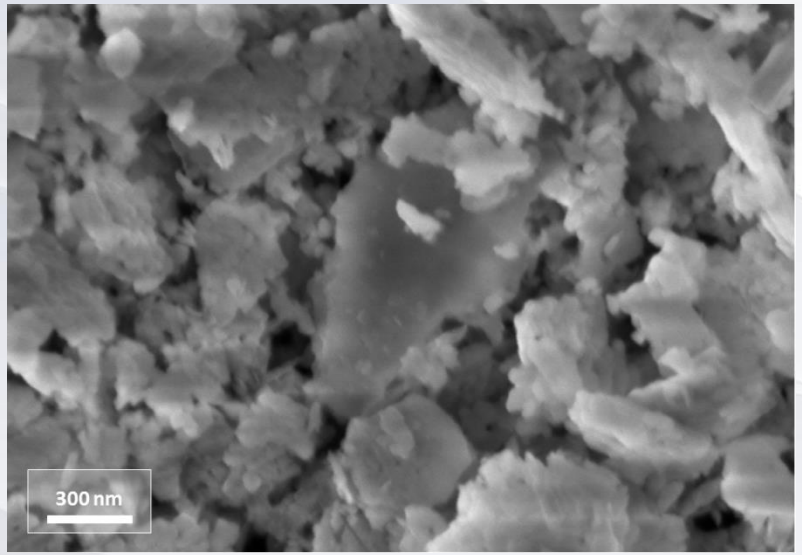
II,2, Characterization of mixed Powders by SEM

II,2,2, Morphological changes during milling Time using attrition milling:

II,2,2, Morphological changes during milling Time using attrition mill:

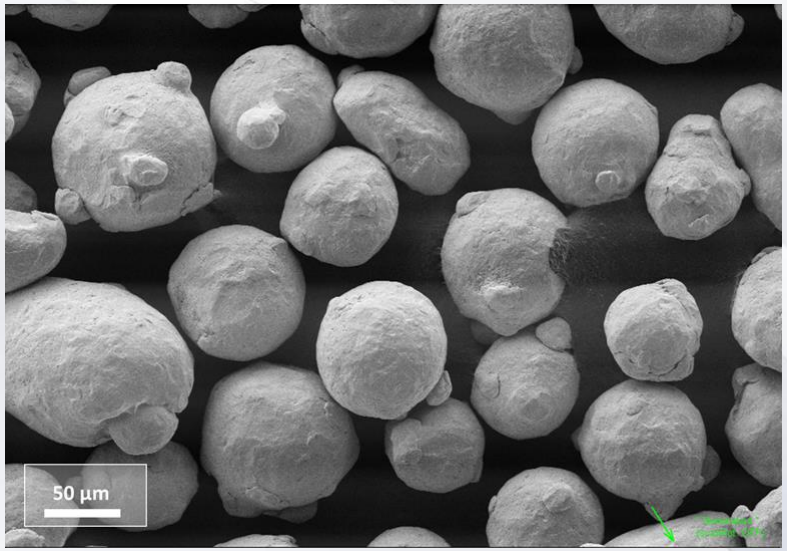
II,2,2,5: Morphology of the Höganäs 316L after **5h** of attrtion Milling



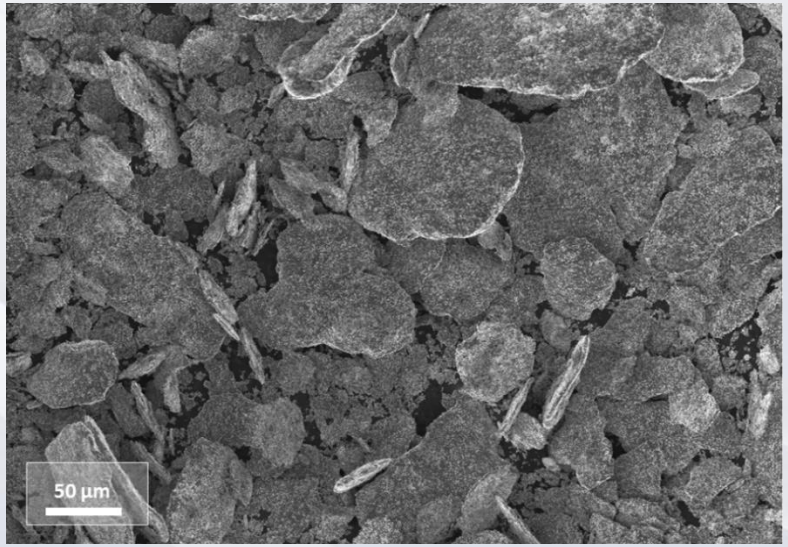


MILLING EFFICIENCY

Starting Powder



BALL MILLING



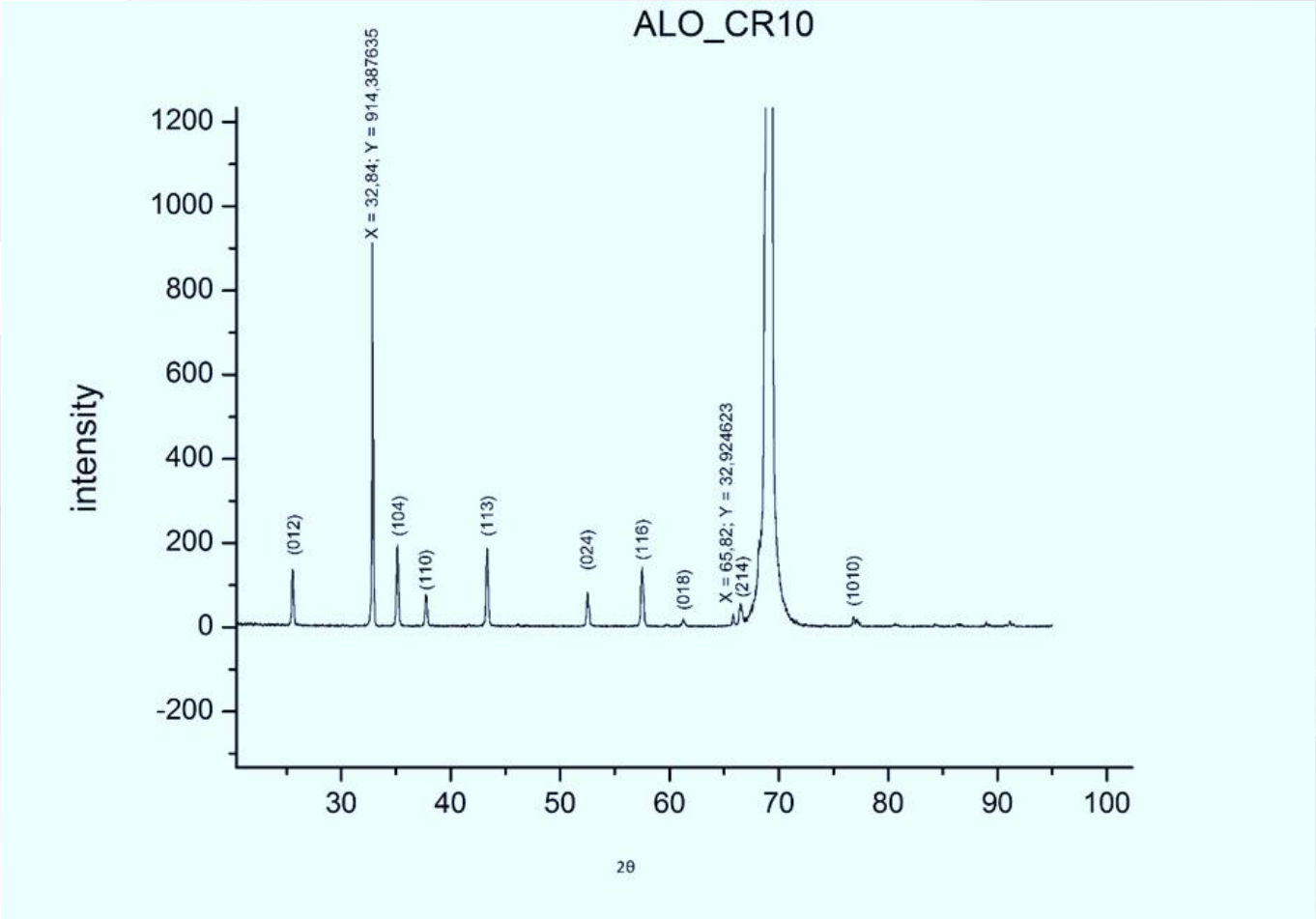
After 10 hours

ATTRITION MILLING

After 5 hours

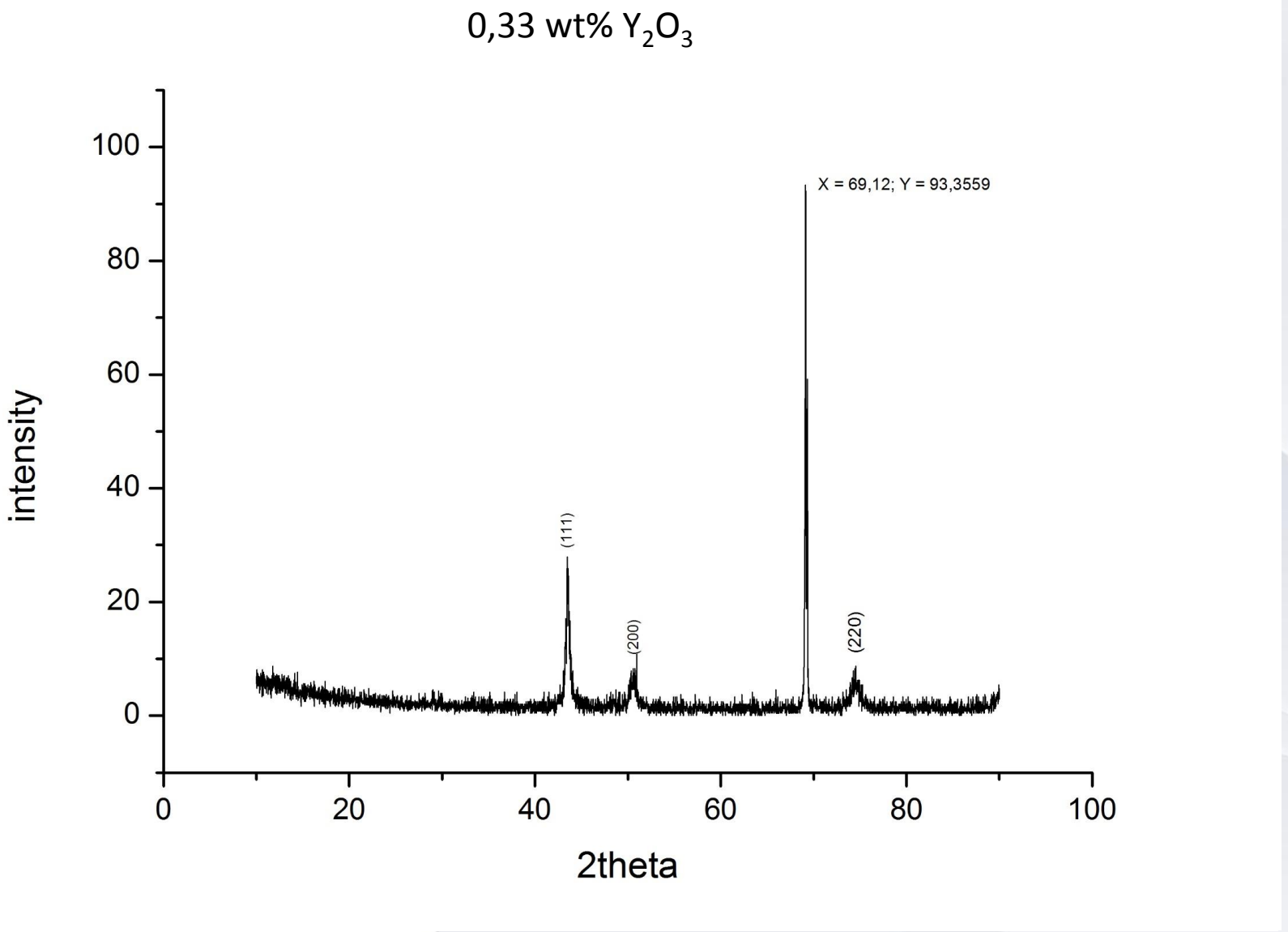
II. Actual Semester Results:

Characterization of starting Powders by XRD :



II. Actual Semester Results:

XRD:

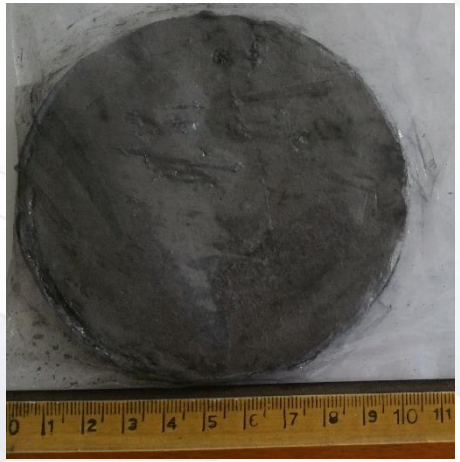


Sintered Samples (by SPS):

the available quantity of prepared alloys, solid Samples and the sintering parameters are shown in following table:

	1 % of Y_2O_3	0.333 % of Y_2O_3	1 % of Si_3N_4	0.333 % of Si_3N_4	1 % of SiC	0.333 % of SiC	1 % of Al_2O_3	0.333 % of Al_2O_3	Reference Sample
Available amount of Alloy (g)	600	600	600	600	600	600	1200	1200	1200
Used Amount of Alloy (g)	600	600	600	600	600	600	/	/	/
Sintering Temperature (°C)	900	900	900	900	900	950	/	/	/
Sintering Time (min)	5	5	5	5	5	10	/	/	/
Solid Samples (disks)	1	1	1	1	1	1	/	/	/

Sintered Samples (by SPS):



1wt% Si_3N_4 Sintered at 900 C° for 5 min

0,33 wt% Si_3N_4 Sintered at 900 C° for 5 min

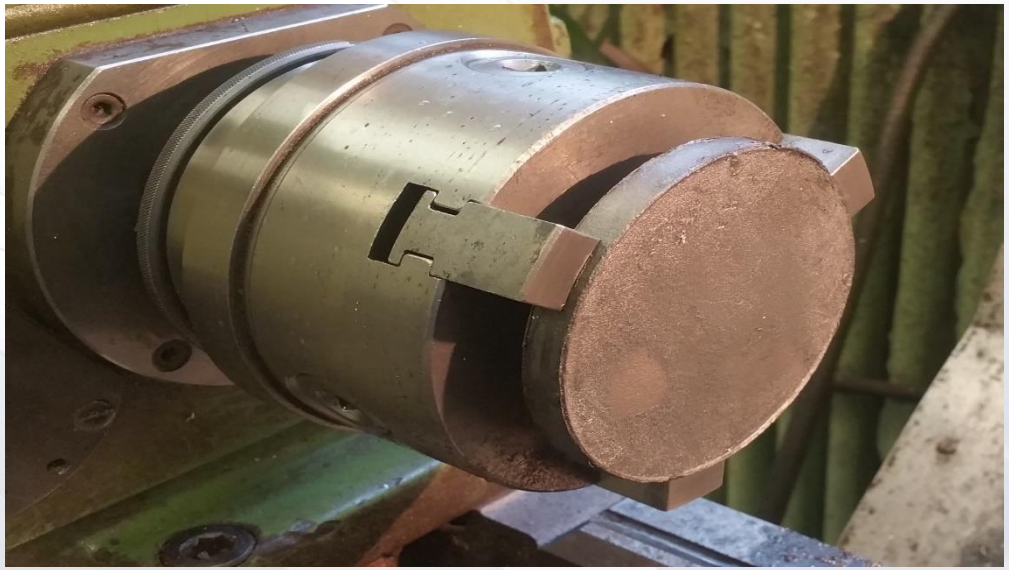
1wt% Y_2O_3 Sintered at 900 C° for 5 min

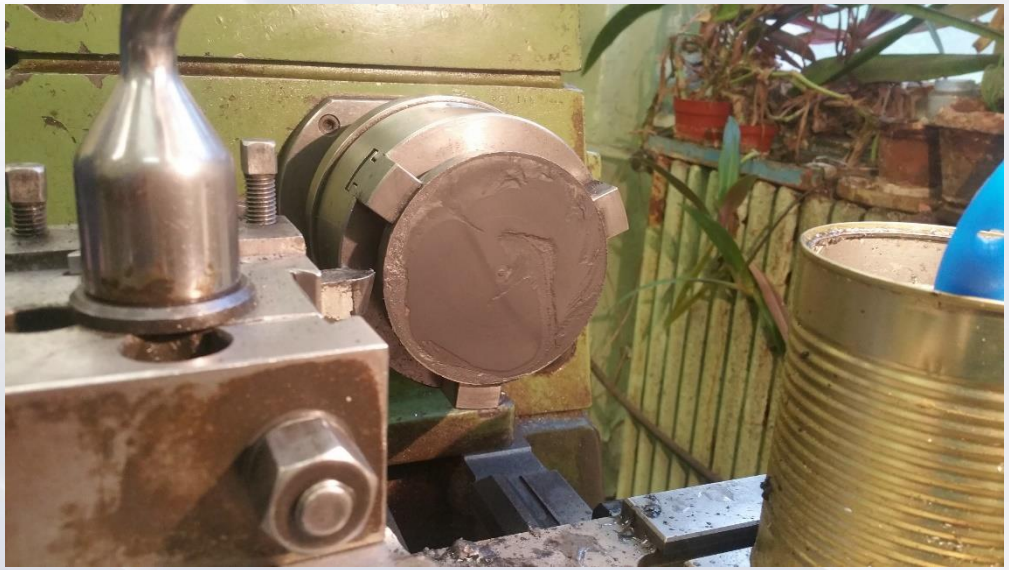
0,33 wt% Y_2O_3 Sintered at 900 C° for 5 min

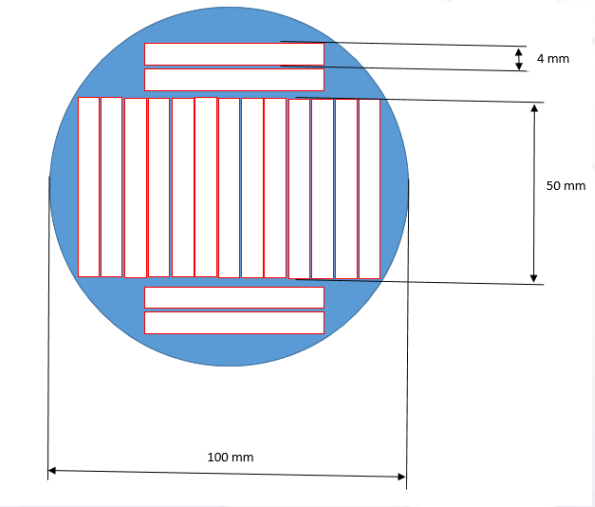
0,33 wt% SiC Sintered at 950 C° for 10 min

1 wt% SiC Sintered at 900 C° for 5 min

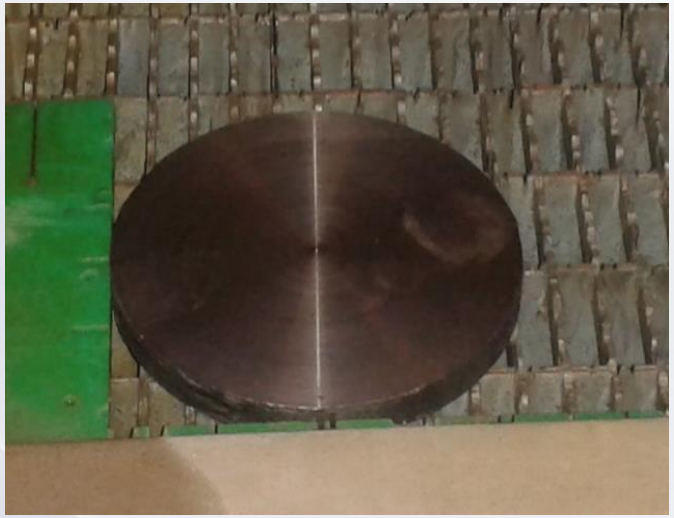
SURFACE PREPARATION BEFORE WATER CUTTING:



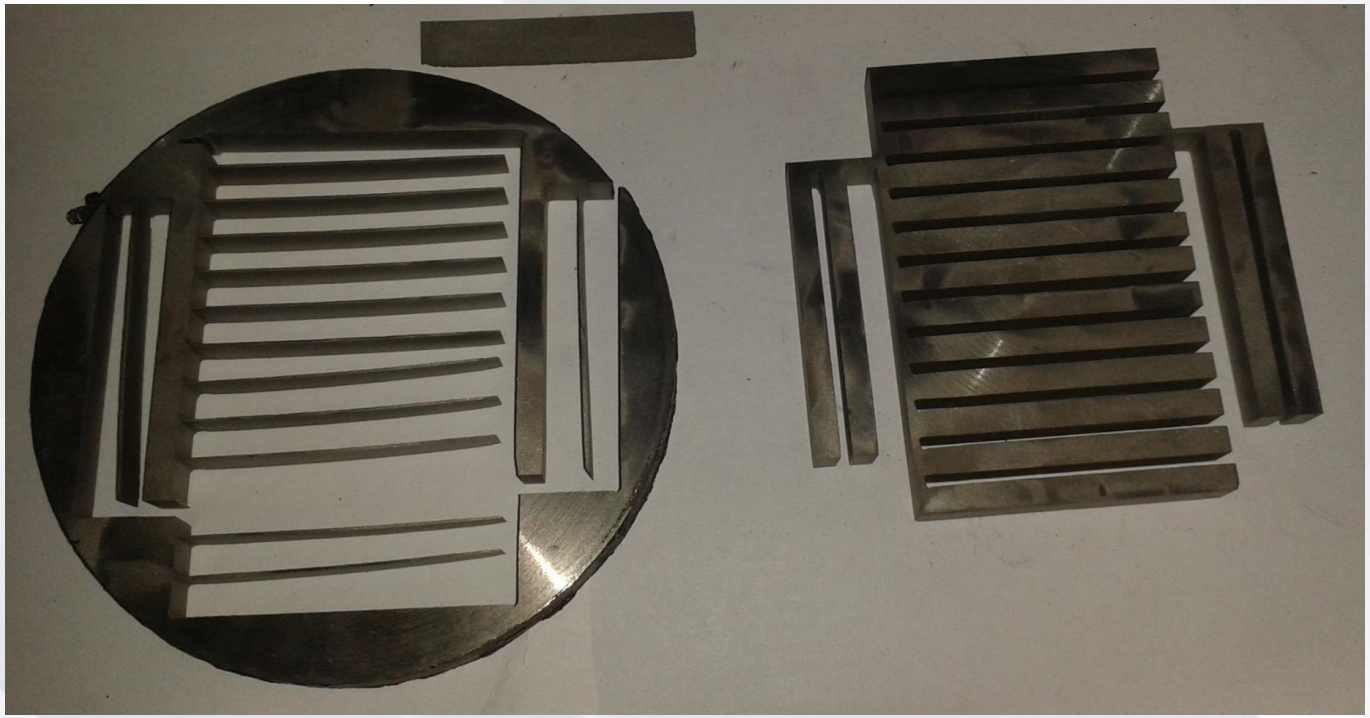



4 mm
50 mm
100 mm

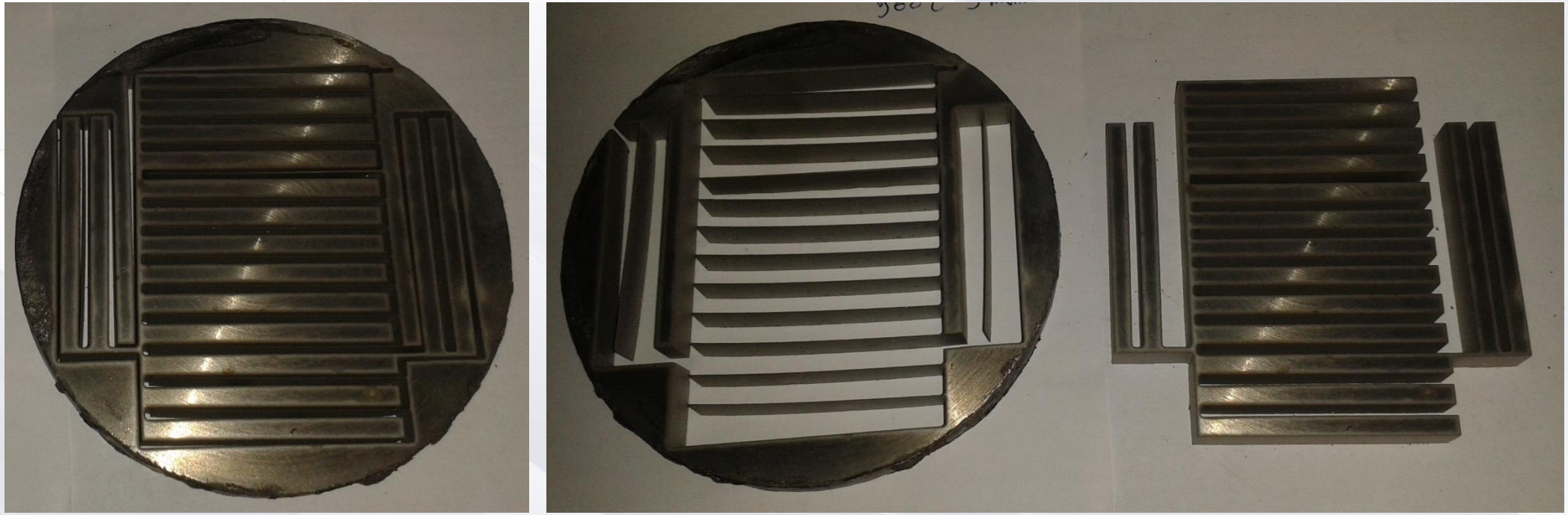

SAMSUNG
EMERGENCY



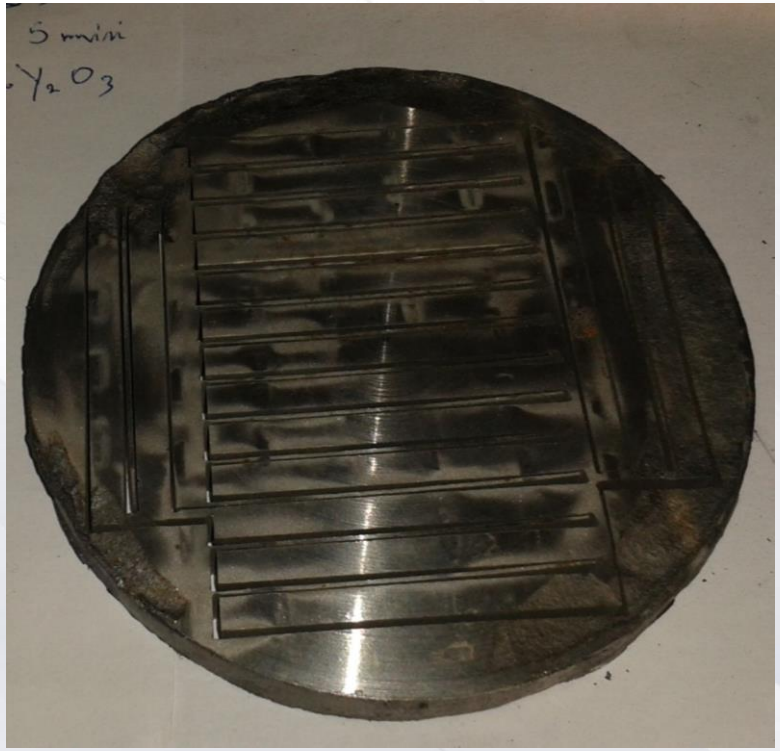
1wt% Si_3N_4 Sintered at 900 C° for 5 min

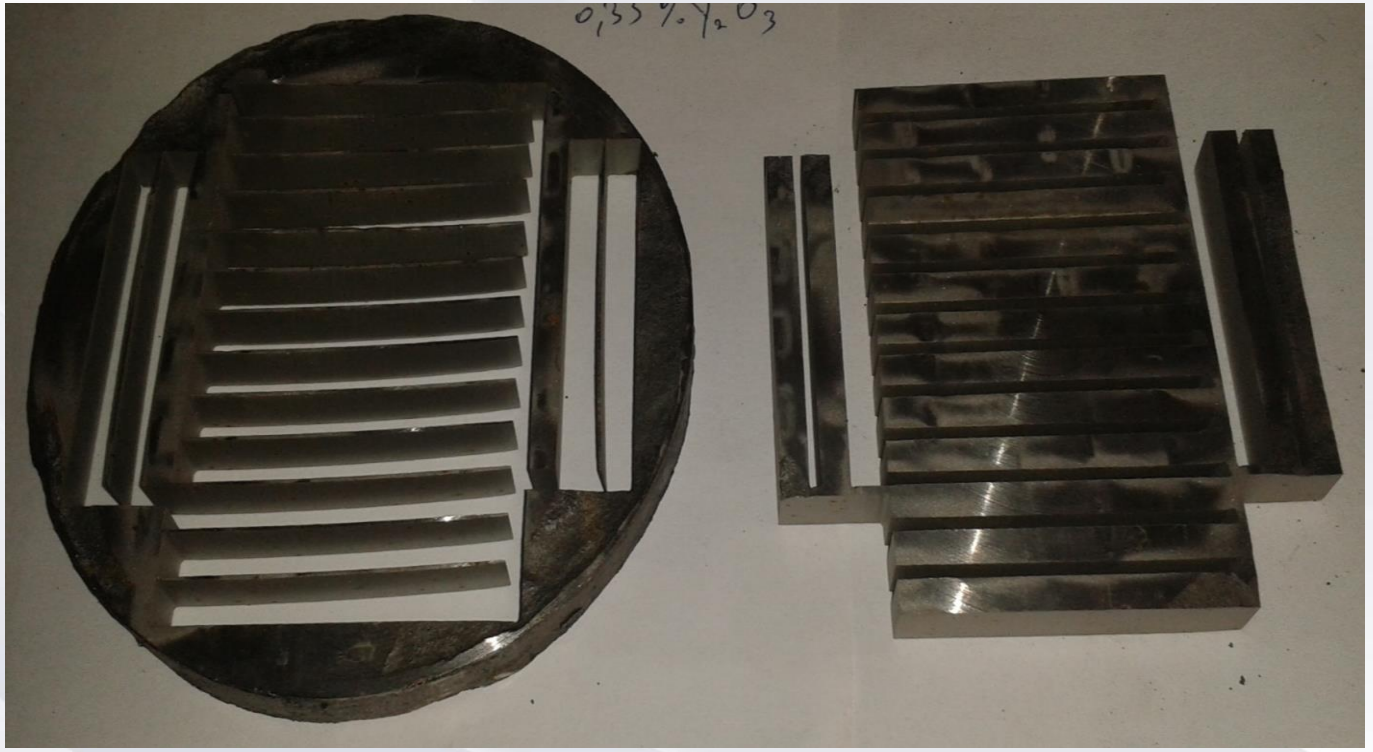


0,33wt% Si_3N_4 Sintered at 900 C° for 5 min

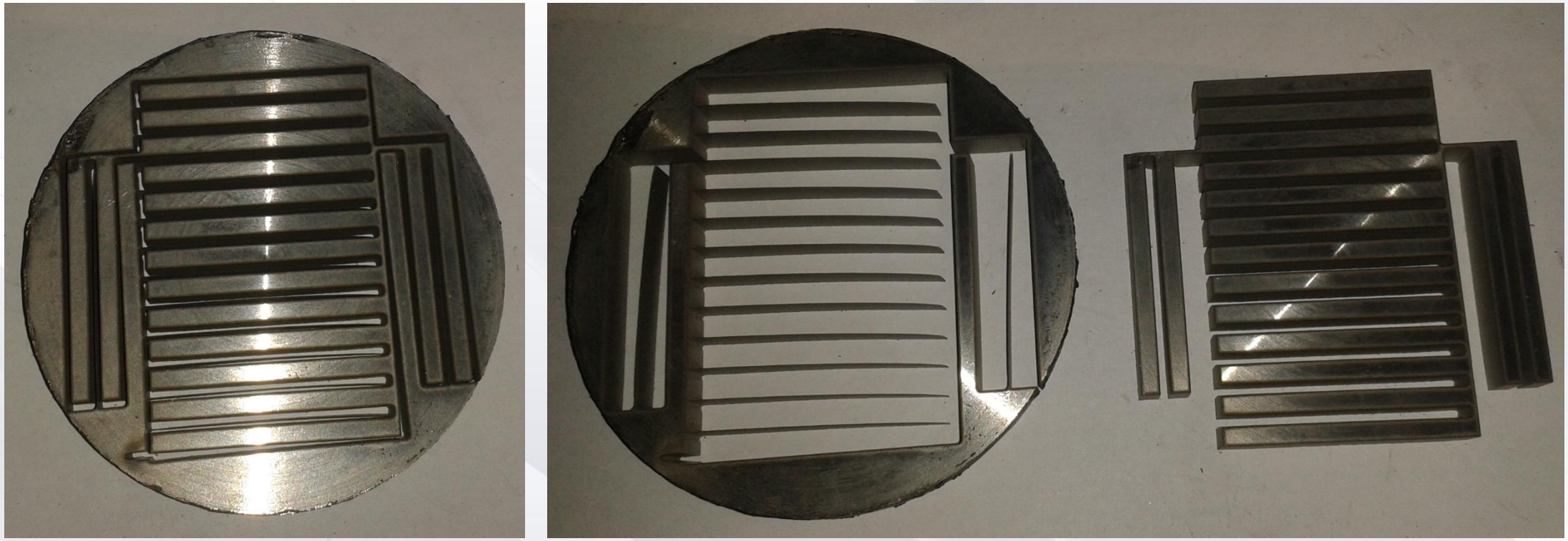


1wt% Y_2O_3 Sintered at 900 C° for 5 min

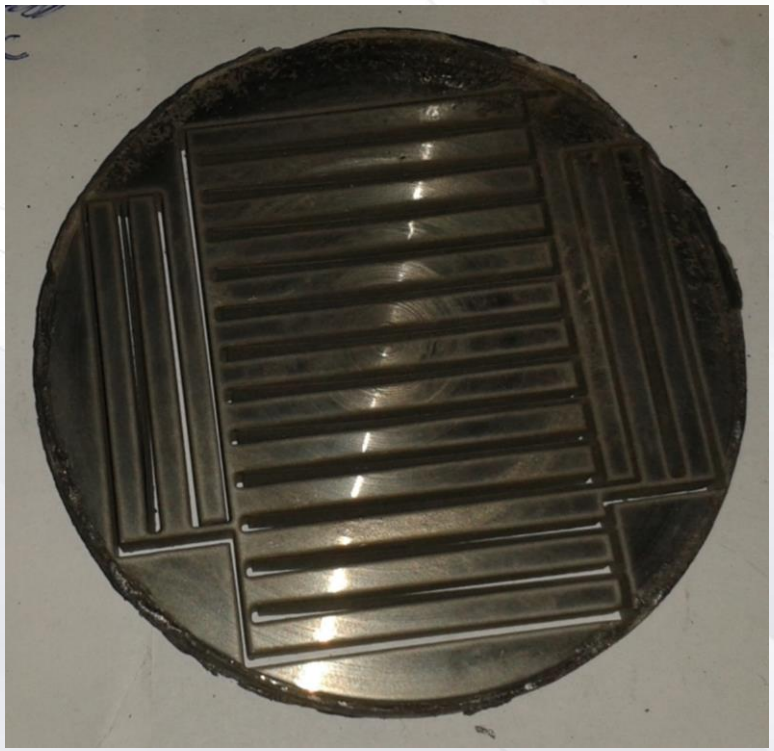


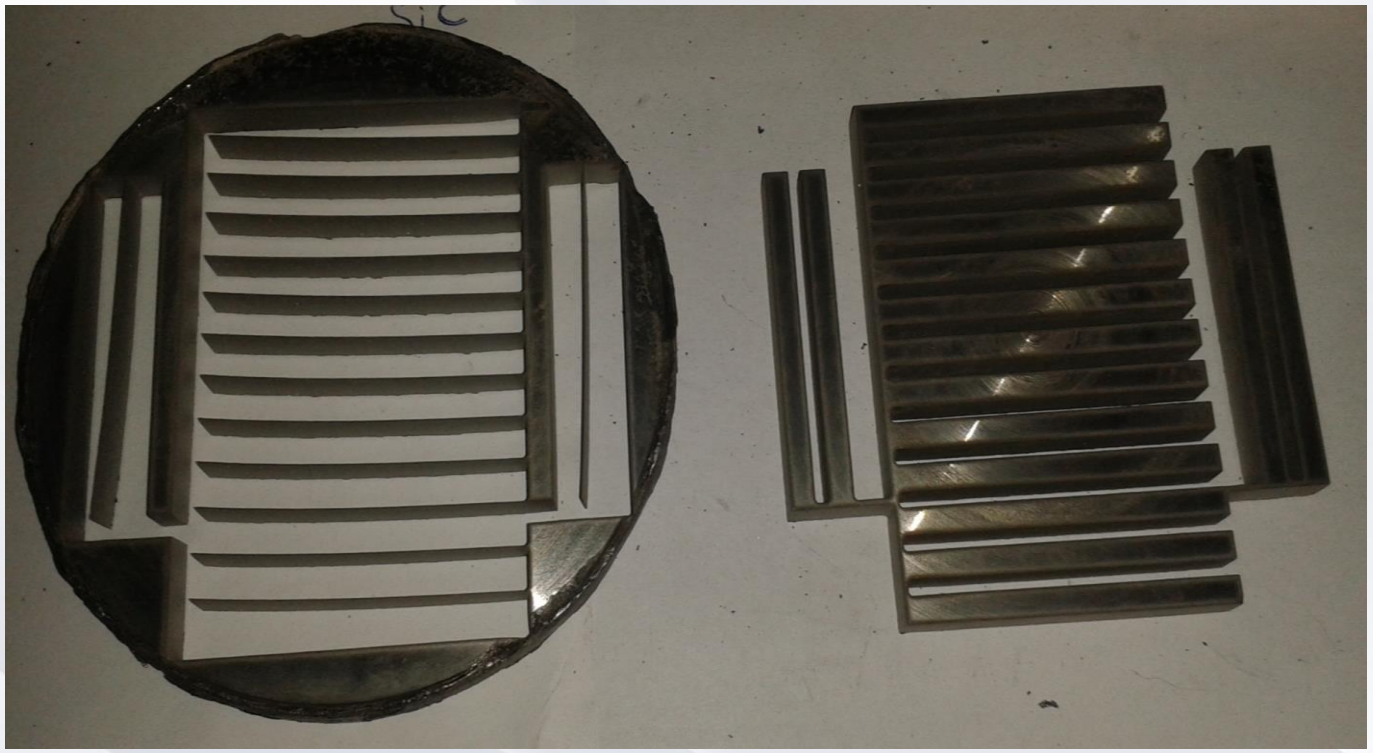


0,33 wt% Y_2O_3 Sintered at 900 C° for 5 min



1wt% SiC Sintered at 900 C° for 5 min





0,33 wt% SiC Sintered at 950 C° for 10 min

III. Summary about the actual semester:

1. **Taken Subjects:**

- Finishing 4 subjects during the actual semester:

  1. Phenomena regarding with continuous casting of steel, Professor Réger Mihály, Óbuda University

  2. Electrochemical methods of measurement and the inhibition of corrosion, Dr. Shaban Abdul, MTA TTK

  3. Selected chapters from the materials characterization methods I. Professor TAKACS Erzsebet, MTA EK & Professor Judit Telegdi. MTA EK

  4. Selected chapters from the materials characterization methods II. Dr. Szilvia Klebert, MTA TTK

III. Summary about the actual semester:

2. Publications & conferences:

- Participating in SMINS-4 in Manchester by poster & short oral poster presentation
  H.R. Ben Zine, C. Balázsi, K. Balázsi, A. Horváth, Development of nanostructured ODS steels by powder technology, NEA International Workshop on Structural Materials for Innovative Nuclear Systems, 11-14 July 2016, Manchester, UK, Poszter
- H.R. Ben Zine, F.S. Cinar, O. Yucel, K. Balázsi, A. Horváth, C. Balázsi, Preparation and Investigation of Boron Nitride Dispersion Strengthened Steels, 14th International Symposium on Novel and Nano Materials, 2016. July 3-8, presentation

III. Summary about the actual semester:

3. Experimental work:

- Preparing a reference sample powder for SPS
- Preparing two alloys for SPS (316L with 0.33% & 1% Al_2O_3)
- Surface preparation of the Sintered Samples
- Cutting 6 big samples by Water cutting
- Reading about cryogenic milling and checking the necessary equipments for it in the Laboratory

IV. Plans for future work:

- Continuing with Samples preparation (secondary cutting, polishing)
- Characterization of the samples (SEM, TEM, XRD, Tribology, 3&4 points bending, density, corrosion resistance..)
- Preparation of the similar alloys using cryogenic milling
- Evaluation of results and preparation of publication (journal with IF)

End Of Semester Presentations
26-27 /01/2017, Budapest, Hungary