Investigation of anomalous densities of high-energy alpha-particles tracks in CR-39 detectors during electrolysis of heavy water on palladium cathodes.

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Oriani's claims

Abstract

A relatively simple technique using CR39 particle detectors has been developed that in 25 consecutive electrolyses has reproducibly produced charged particle tracks, showing unambiguous evidence of a nuclear reaction during electrolysis of heavy or light water solutions. Nuclear tracks can be produced upon the surface and beyond the 1 mm thickness of the CR39 detectors. Nuclear activity of some sort can persist in the Viton o-rings used in the electrolysis cell so that charged energetic particles can be generated subsequently without electrolysis.

Repeatable technique for the generation of a nuclear reaction during electrolysis

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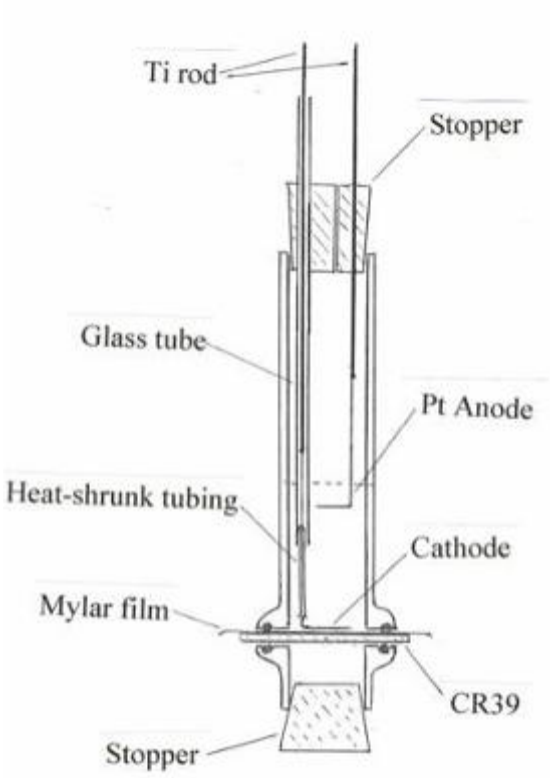
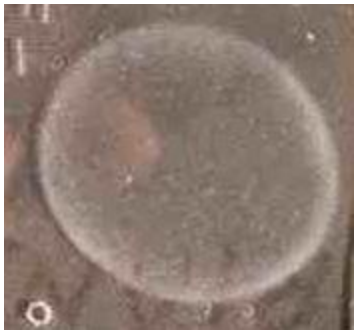
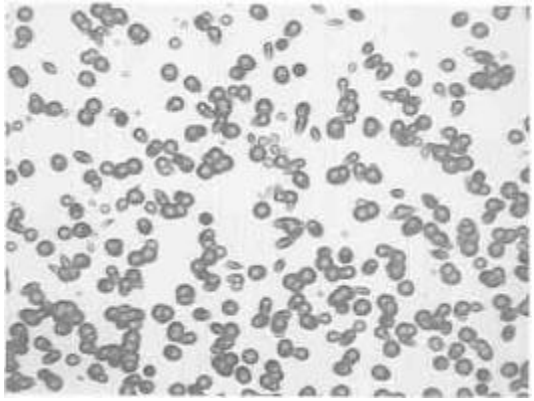






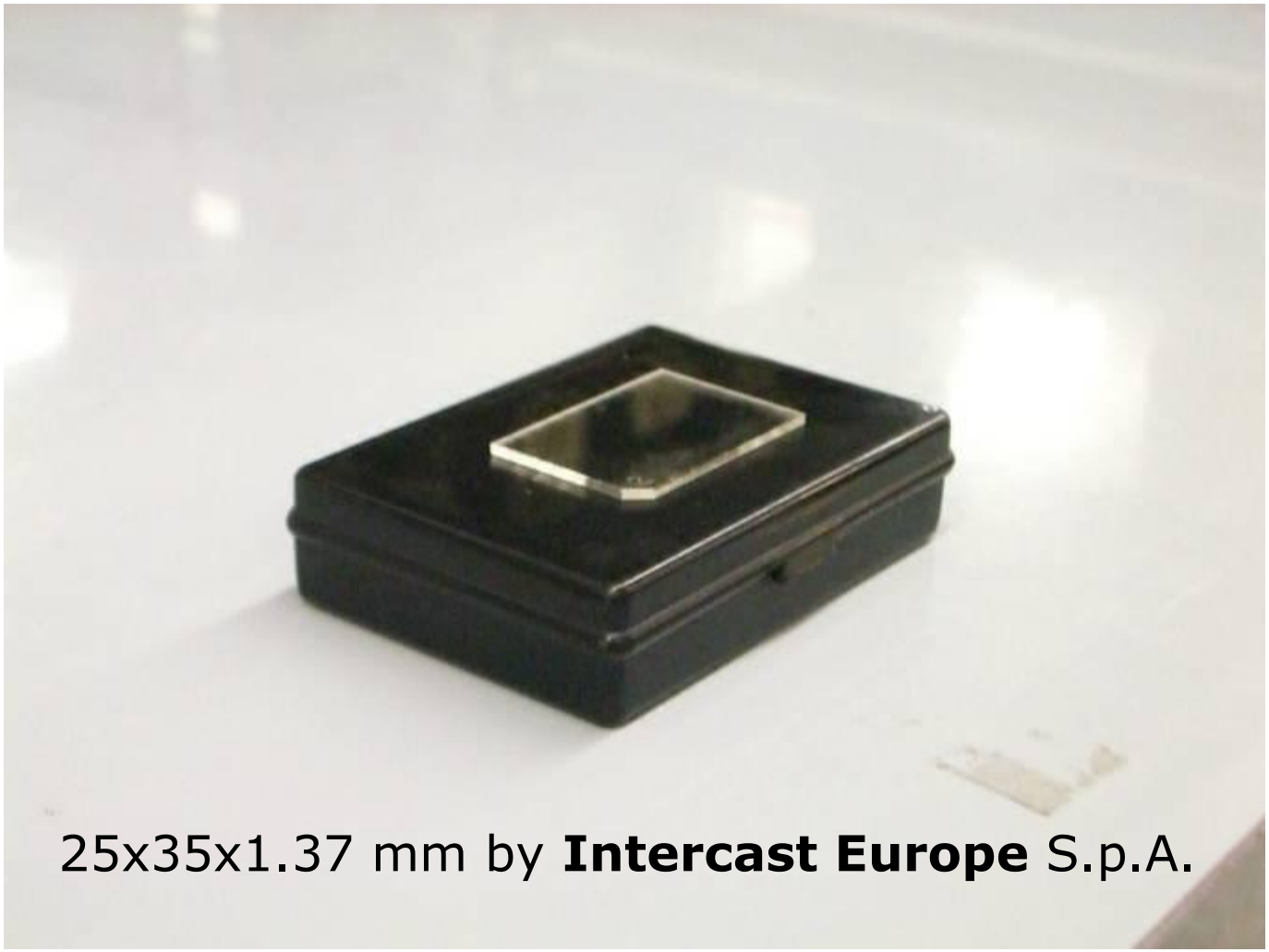
Oriani's results

- Examination showed that haze patterns following the circumference of the o-rings had developed, similar to that illustrated by Fig.5. However, the central regions of the areas bounded by the haze rings were clear. The track densities were 55 tracks/cm^2 on one chip and 70 on the other. These numbers are to be compared with the background value of 55 per cm2 and with over 2000 tracks /cm^2 found in the center of the chip pictured in Fig.5.

AIM OF EXPERIMENT

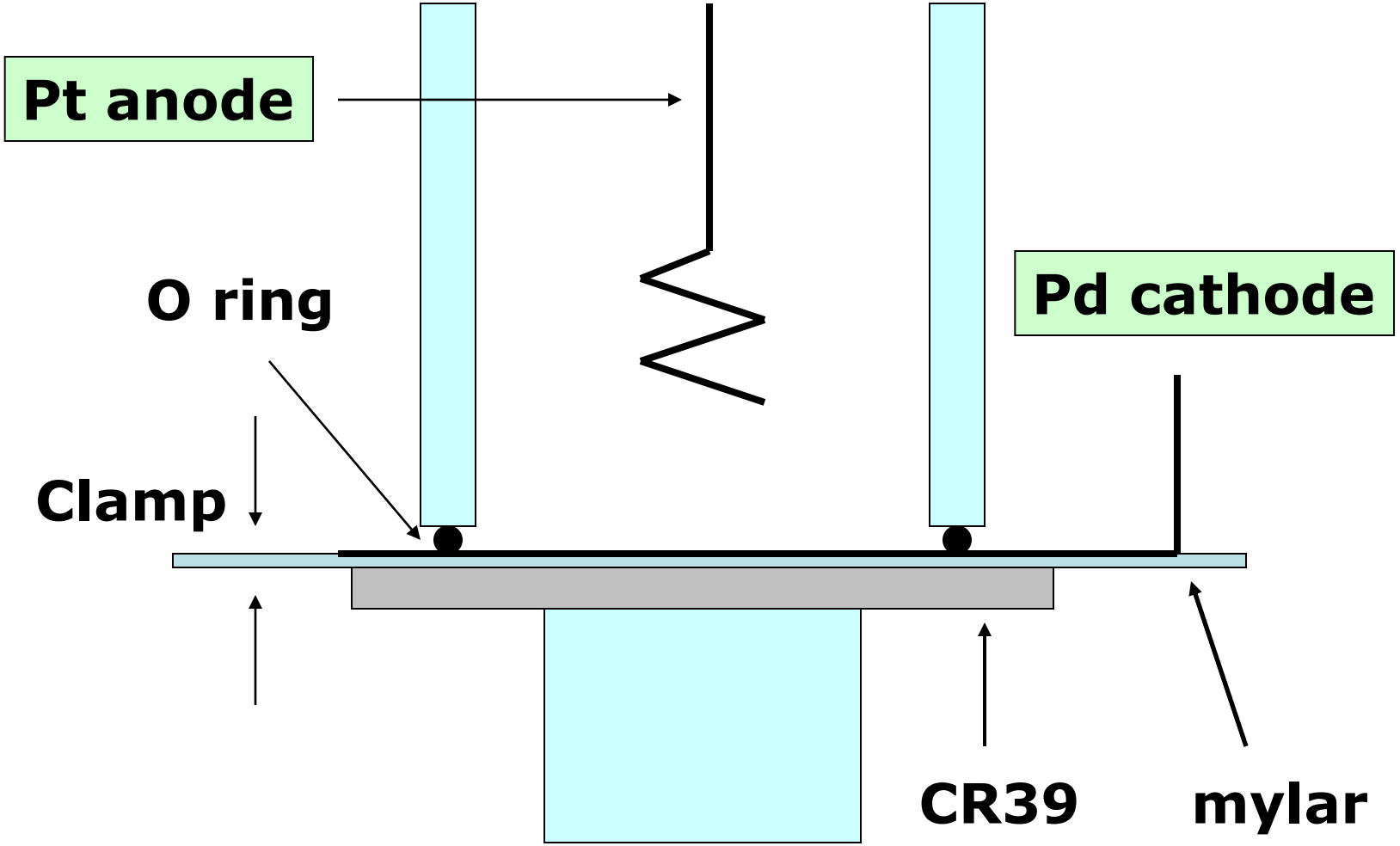
- To detect alpha particles emission from Pd cathode during electrolysis D loading using a standard plastic detector for measurements of radon in the environment
- Expected tracks density from Pd cathode should be significantly higher than noise level

CR 39 TRACK DETECTOR



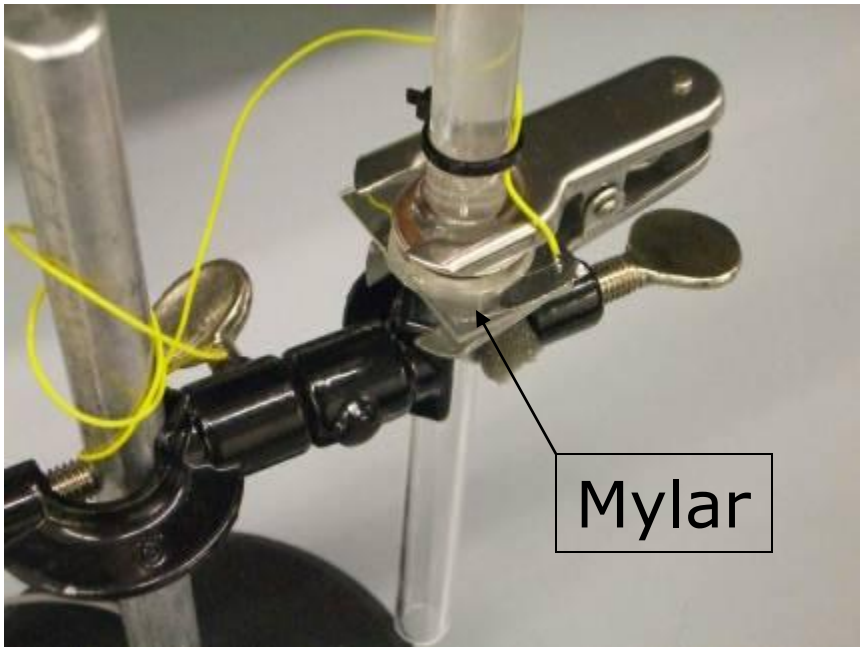
25x35x1.37 mm by **Intercast Europe** S.p.A.

ELECTROLYSIS CELL



HIGHLIGHT OF MYLAR - CR39 ASSEMBLY

CR 39



WHY MYLAR?

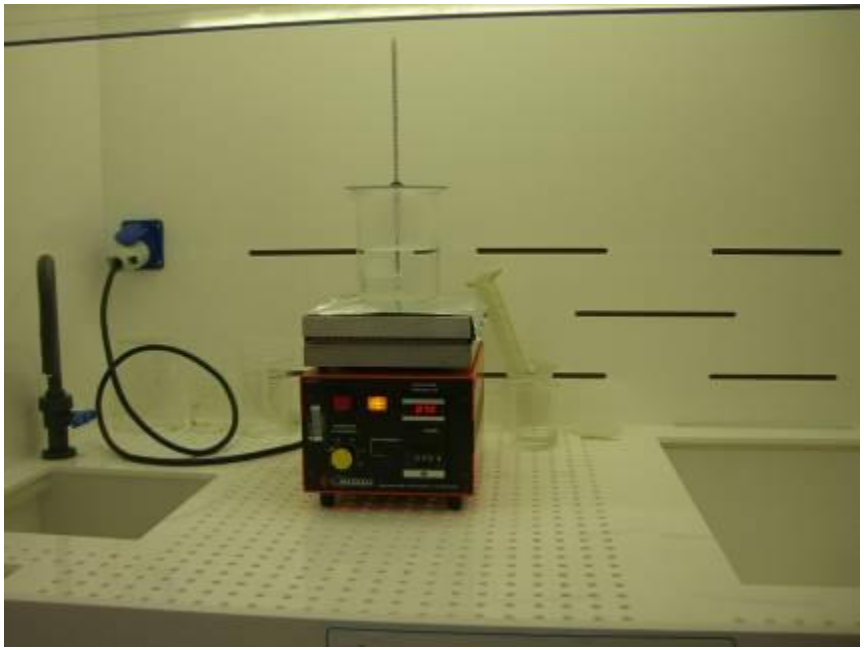
- Mylar interposed between Pd cathode and CR 39 prevents this one to be etched or contaminated by electrolytic solution during D loading
- Artifacts on CR 39 plate can produce wrong interpretation of results. We think this happened in some experiments from others experimentalist

ELECTROLYSIS PARAMETERS

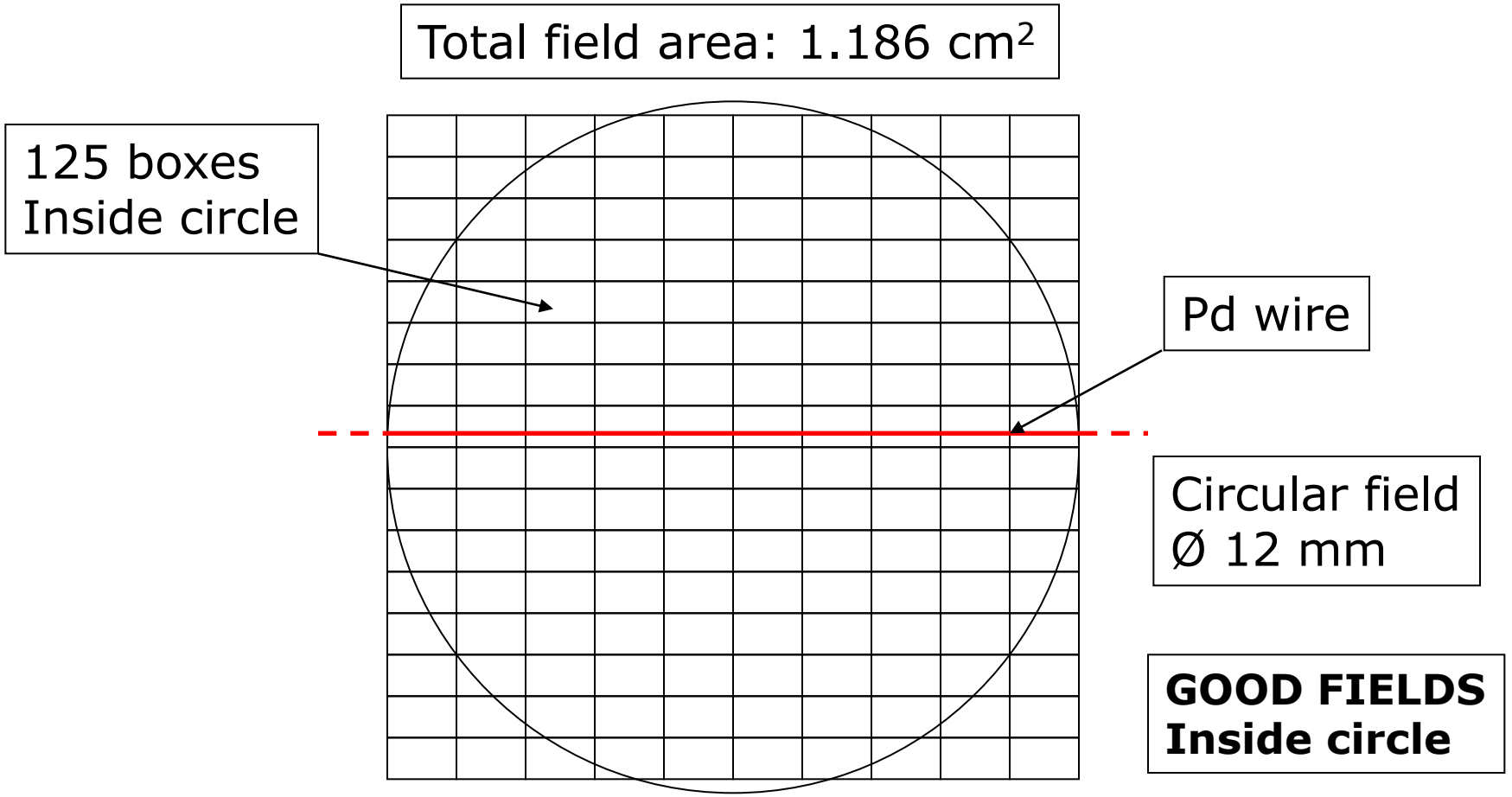
- LiCl 0.5 M in 10 mL D_2O
- I_c :10 mA; (~ 0.5 A/cm^2)
- Cathode :Pd wire, Ø 50 µm, 12 mm lengh
- Anode :Pt spiral wire
- Mylar 11 µm thick
- Time: 3 – 7 days

ETCH CONDITIONS

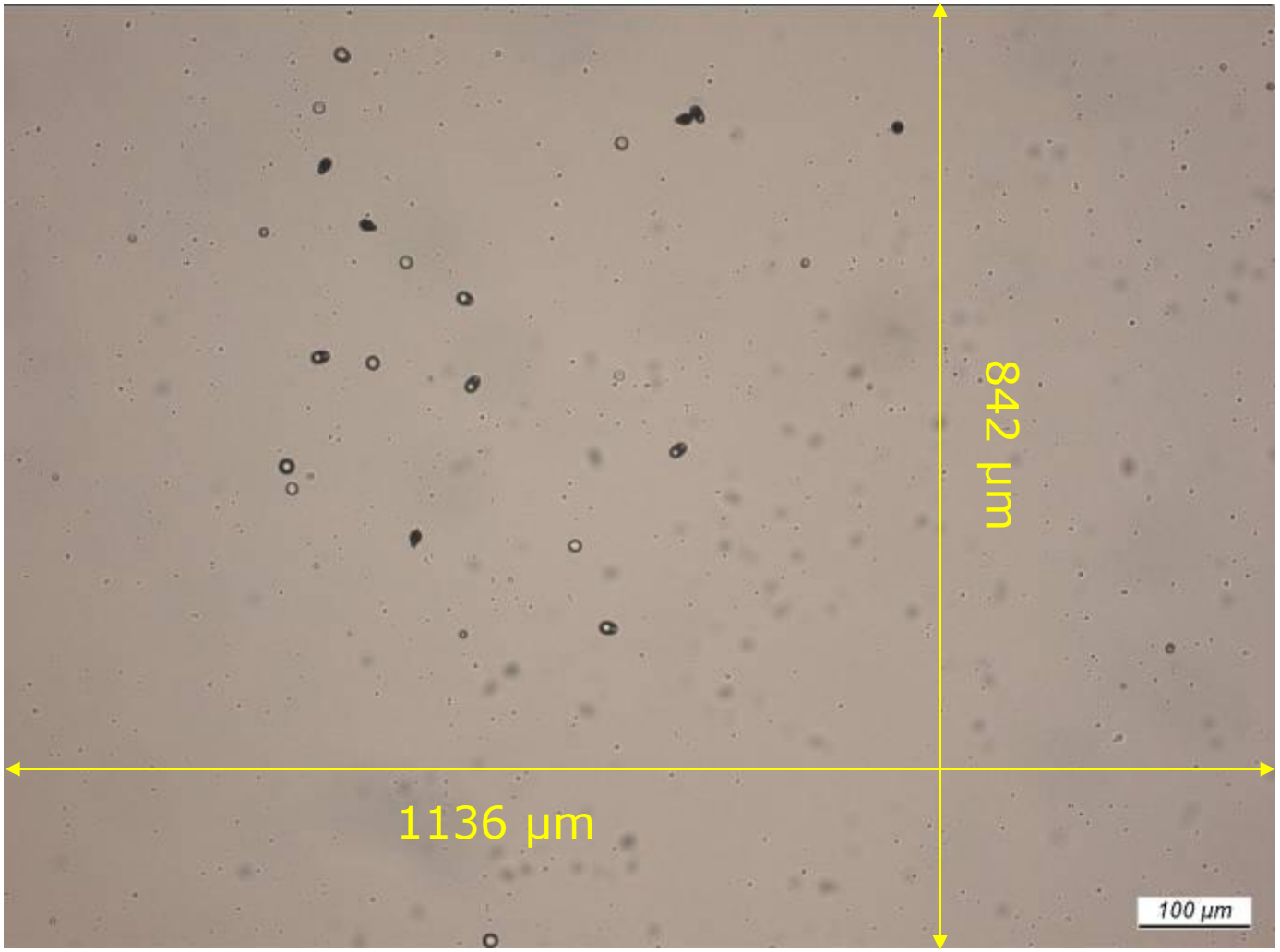
- NaOH 6.25 M @ 70°C for 6 hours
- Heating plate with electronic temperature control
- Thermometer for T° stability check



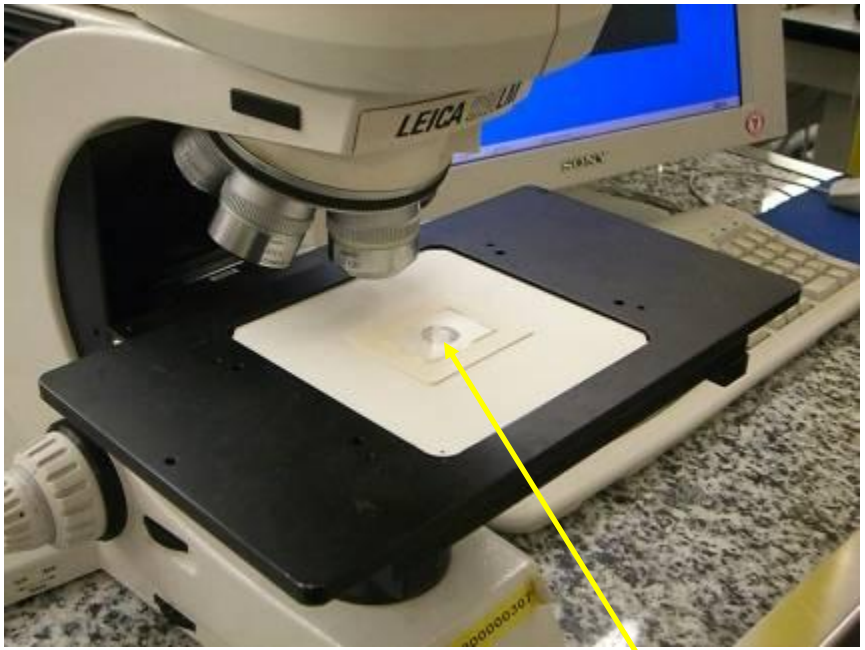
FIELD SCAN GRID



BOX SIZE



TRACKS COUNT SYSTEM



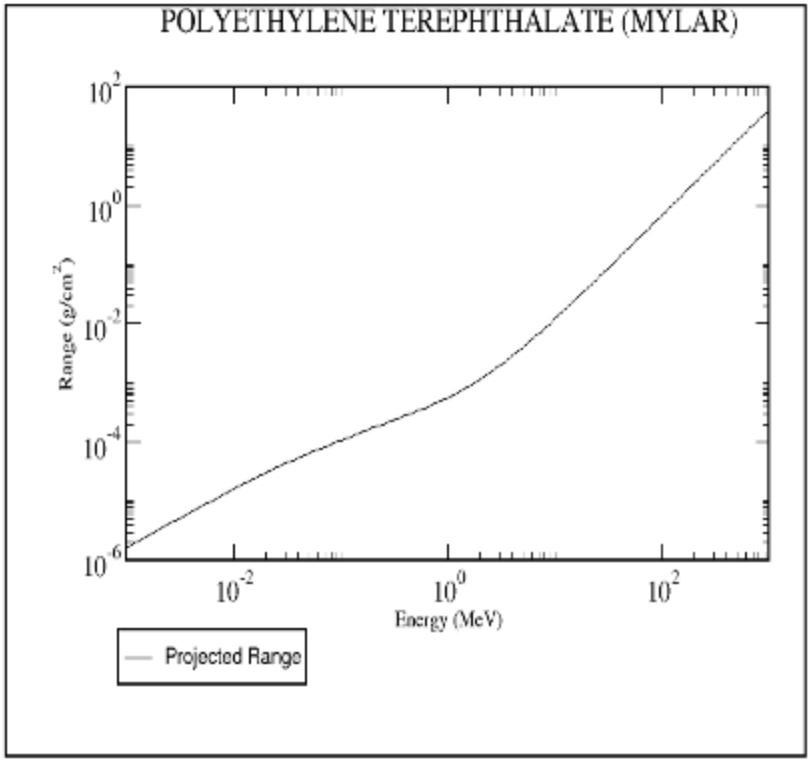
BETHE-BLOCK FORMULA

- SRIM® and NIST® software were used to calculate stopping power *dE/dx* and projected range of alpha particles in mylar
- Projected range for alpha 2.50 MeV is 10.99 µm
- Alpha particles with E > 2.50 MeV cross mylar and leave tracks on CR 39 11 µm th.

POLYETHYLENE TEREPHTHALATE (MYLAR)

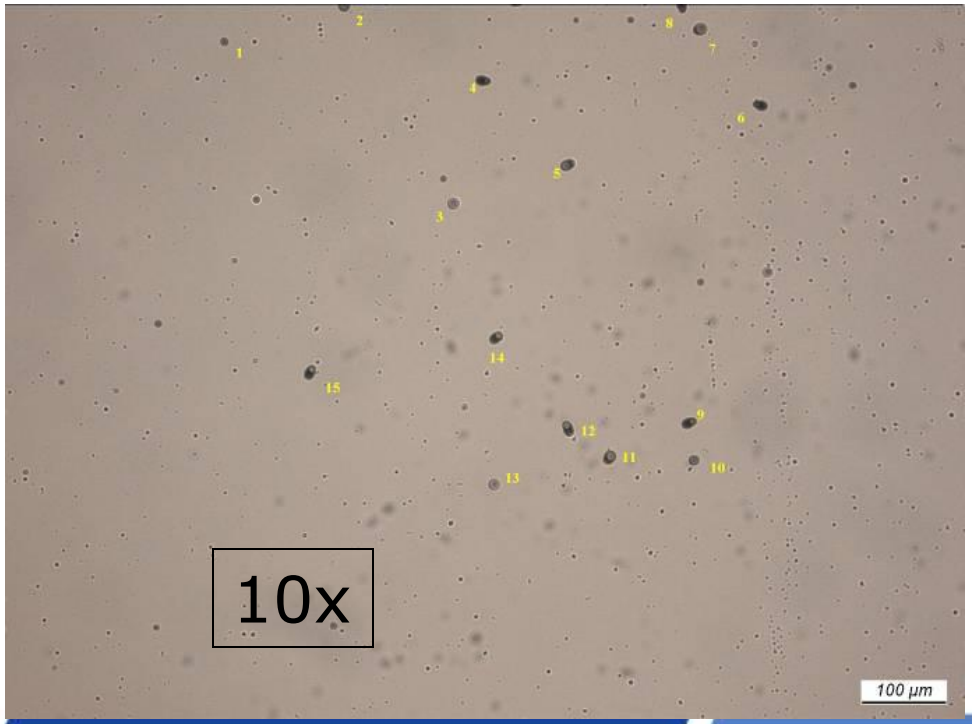
COMPOSITION:	
Density (g/cm^3) =	1.40000E+00
Mean Excitation Energy	78.700000 (eV)

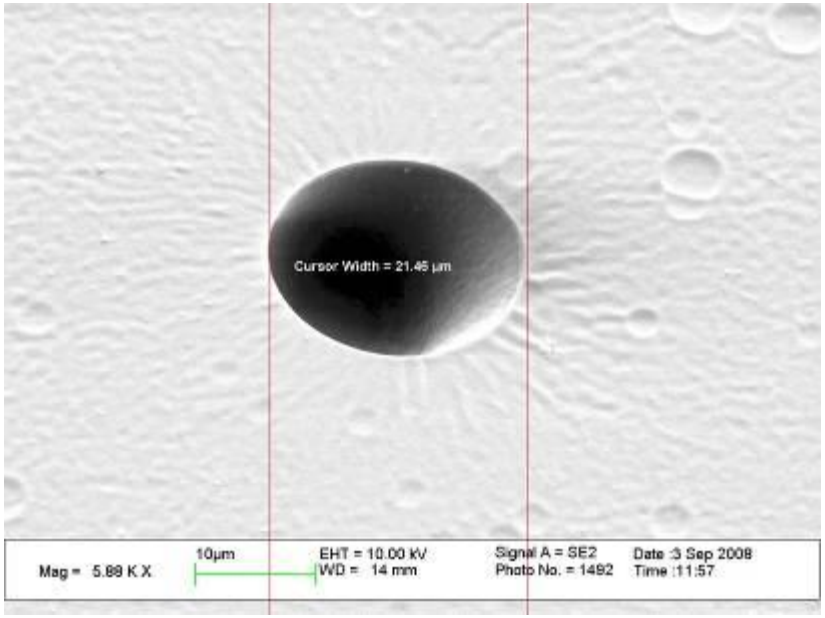
Atomic number	Fraction by weight
1	0.041959
6	0.625017
8	0.333025



Range = ρx

CR 39 TRACKS AFTER ETCH



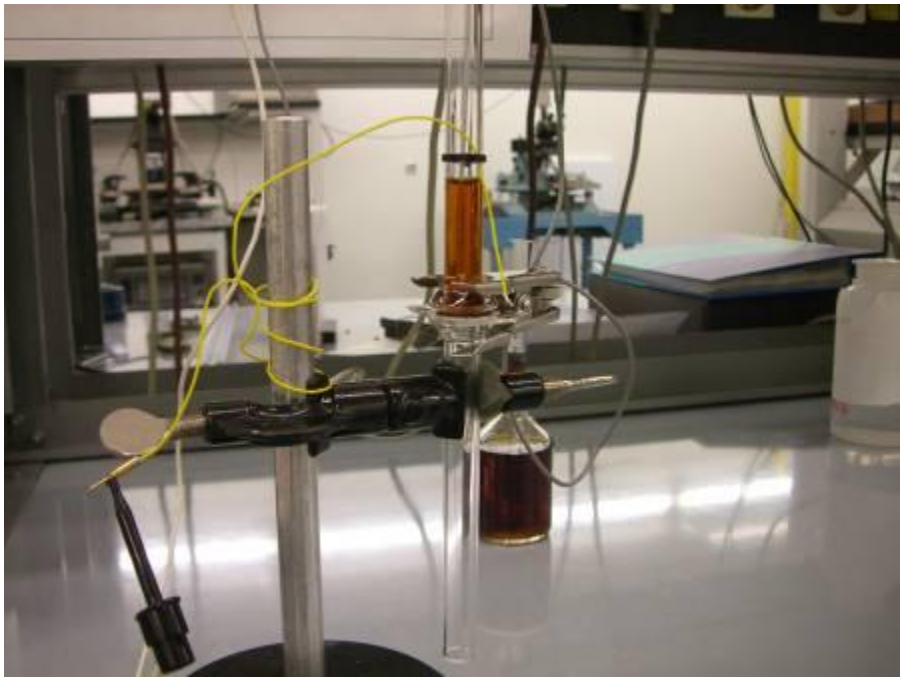


MATRIX OF TRIALS

- 2 Blank Test with D_2O + $LiCl_2$; NO ELECTROLYSIS
- 5 Electrolysis Test with D_2O + $LiCl_2$
- 2 Electrolysis Test with D_2O + $LiCl_2$ + PdCl
- 1 Electrolysis Test, NO MYLAR

CODEPOSITION

- Codeposition of Pd / D from $PdCl_2$ in D_2O
- $PdCl_2$ 0.05 M + LiCl 0.5 M
- Trial 1: 10 mA
- Trial 2: 0.5 mA till total plating, ramp to 5-10-20-40-80 mA



RESULTS

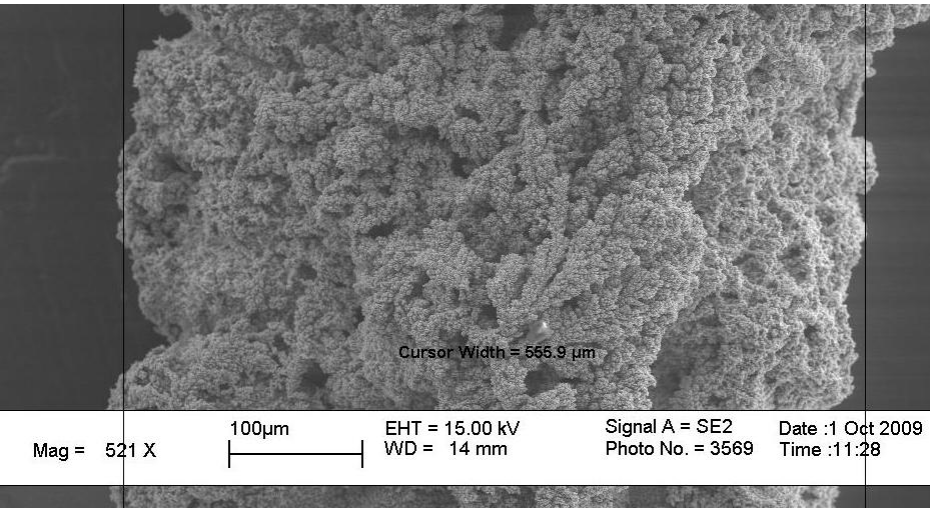
BLANK	
	D (cm^{-2})
EX.1	189
EX.2	154

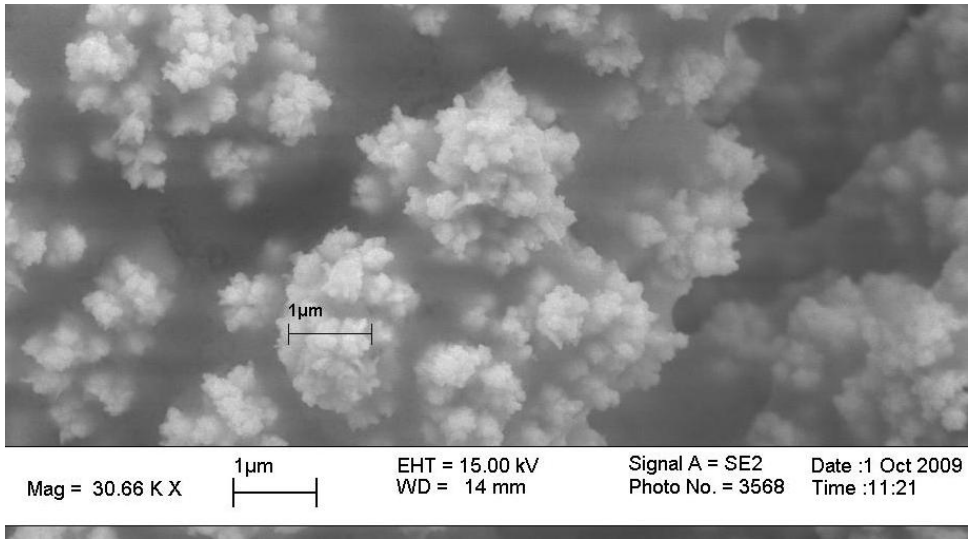
Tab. 3 – Track Density (Codepos.)

Exp. -A-	113 tr./cm^2
Exp. -B-	146 tr./cm^2

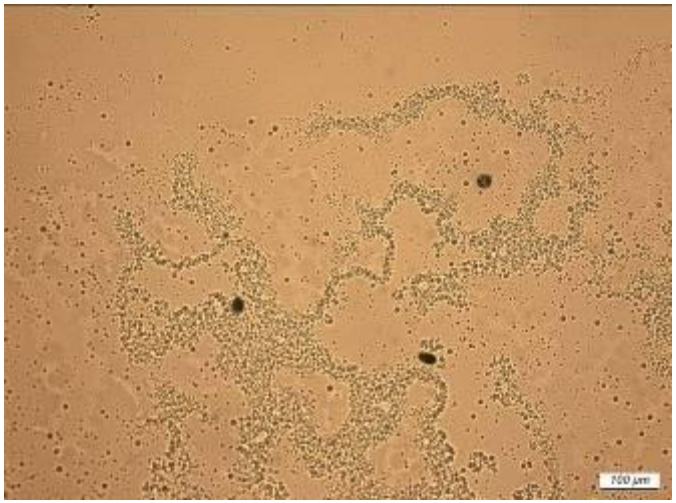
ELECTROLYSIS	
	D (cm^{-2})
EX.1	222
EX.2	296
EX.3	136
EX.4	112
EX.5	74

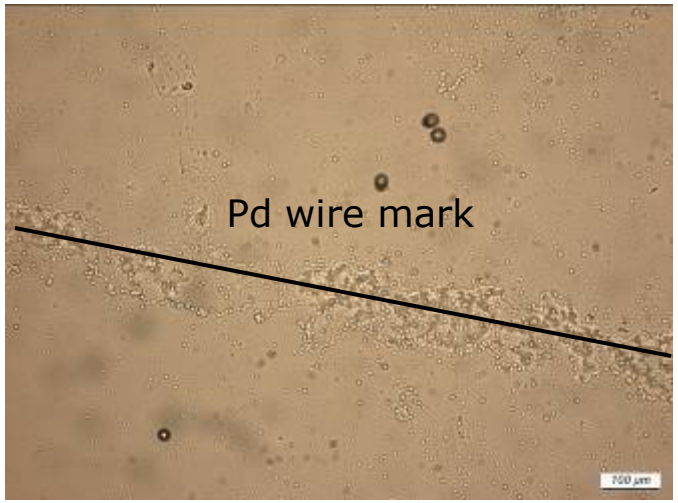
Pd WIRE AFTER Pd/D CODEPOSITION (SEM)



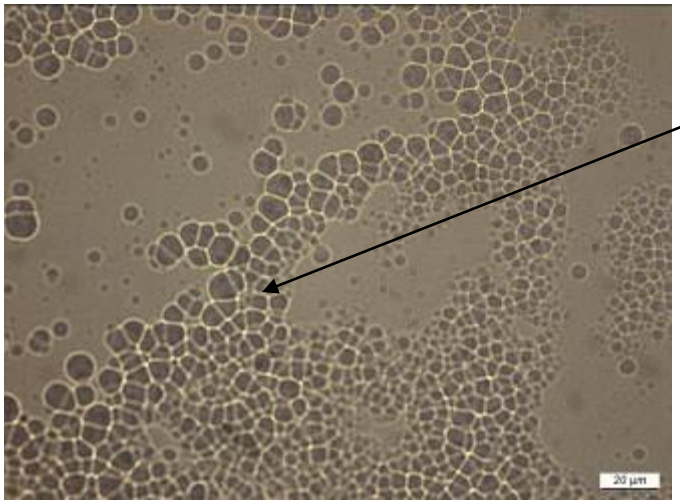


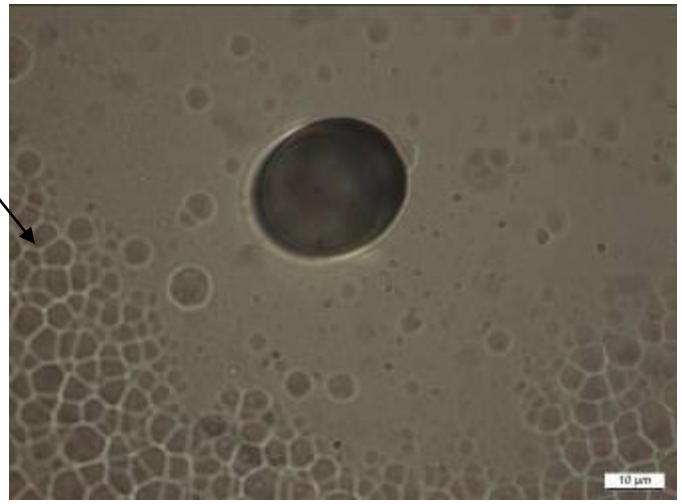
NO MYLAR - OPTICAL



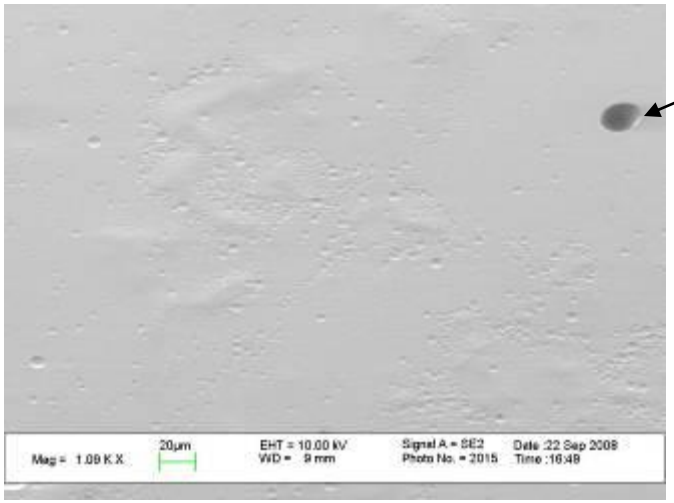


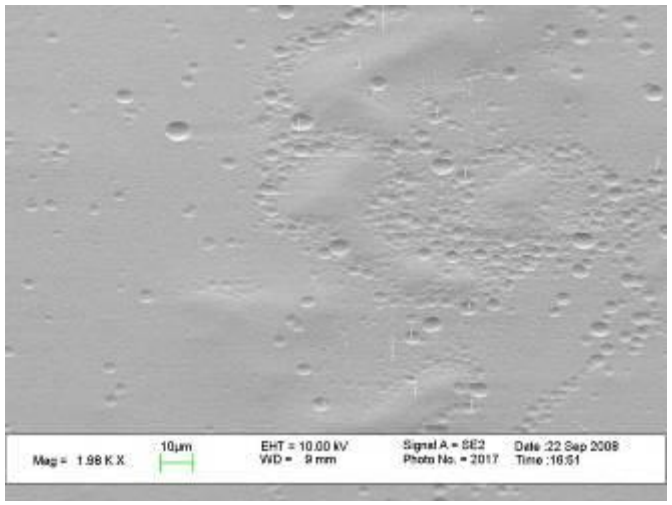
"BOUBBLE"
PITS



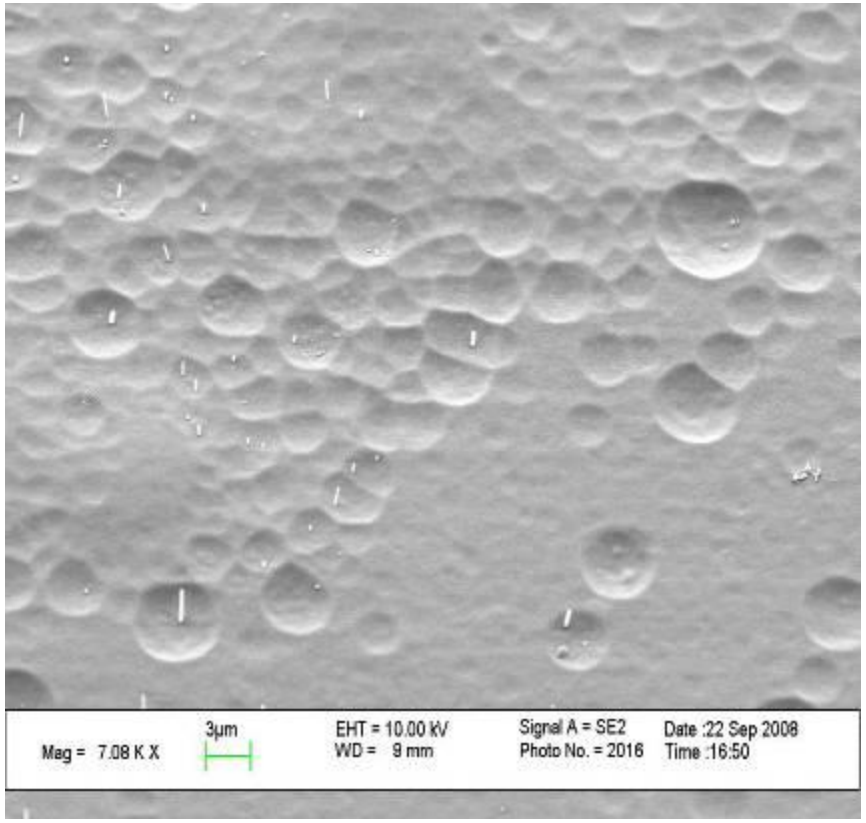


NO MYLAR - SEM





SURFACE DAMAGE

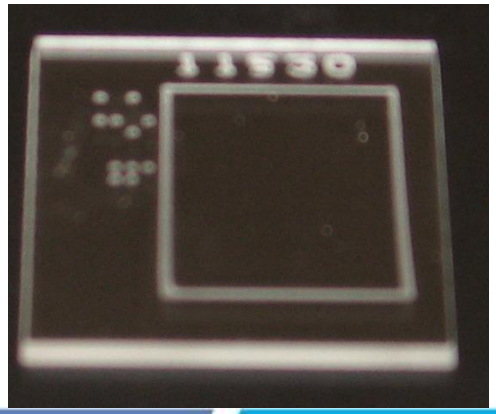


OBSERVATIONS

- Experiments with mylar between electrolyte and CR39 give a pit density of same magnitude compared with blank (no current) test; in one case less.
- Pits appearance in test without mylar is strictly different from nuclear tracks visible on the same chip
- Under the Pd cathode mark there is not an increase of pit density respect to the neighbor

CONCLUSIONS

- No meaningful evidence of specific particle emission with E>2.5 MeV during D_2O electrolysis (comparable track count), with or without Pd codeposition;
- Similar results reported on site www.earthtech.com
- New experiments already started with CR39 TASTRAK detectors from "Trak analysis system ltd"



Acknowledgments

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Thank you for the attention