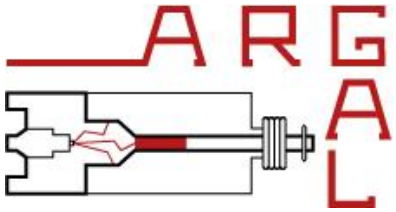

LENR anomalies in Pd-H_2 systems submitted to LASER stimulation

Ubaldo Mastromatteo

Overview

- Background findings about transmutations
- Experiments with He-Ne LASER
- Experiments with solid state 405 nm LASER
- Final remarks
- Conclusions and future activities

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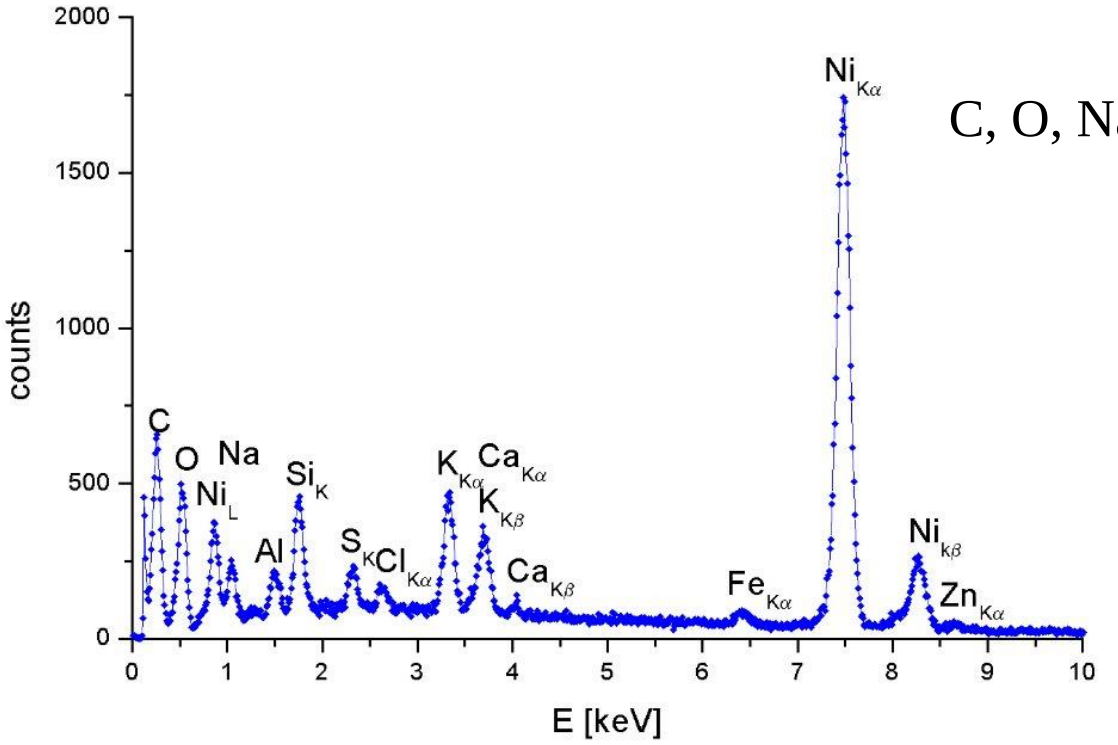
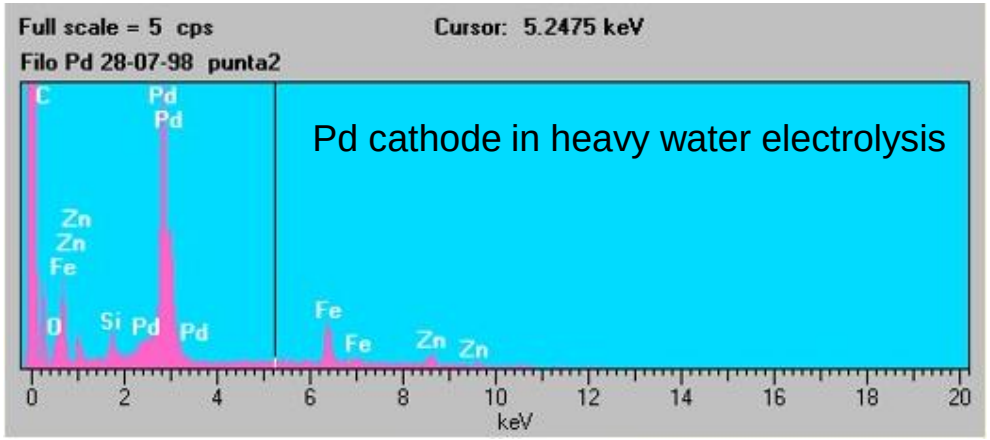
S. Focardi, V. Gabbani, V. Montalbano, F. Piantelli, S, Veronesi, "On the Ni-H System", SIF Conference Proceedings, Vol. 64, pp. 35-47, 1997.



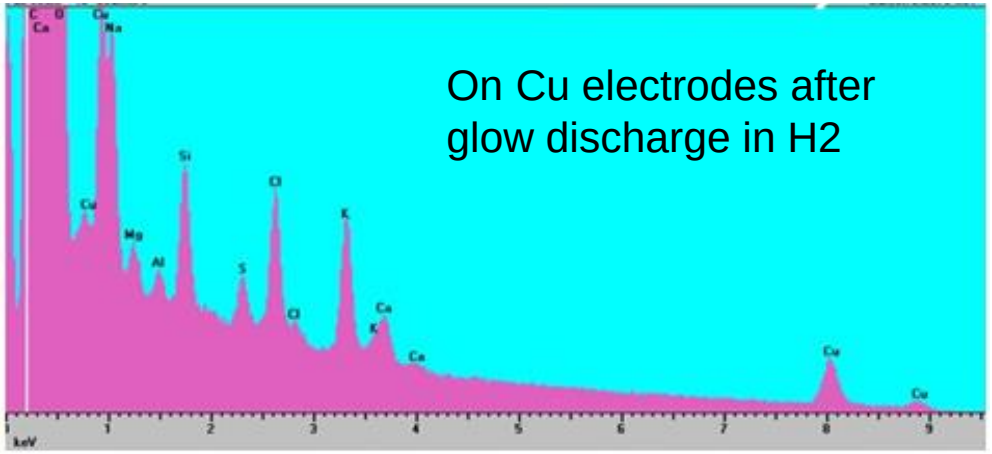
C, O, Na, Al, Si, S, Cl, K, Ca, Fe, Zn

EDX on pure Ni rod after extra heat production in H_2 atmosphere at few hundreds degrees centigrade

L. Gamberale findings (2001) – private communication

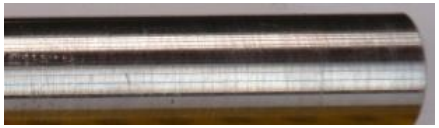


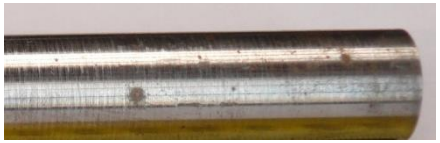
C, O, Si, Fe, Zn



C, O, Na, Mg, Al, Si, S, Cl, K, Ca

F. Cardone, G. Cherubini, A. Petrucci; Piezonuclear neutrons; Physics Letters A 373 (2009) 862-866

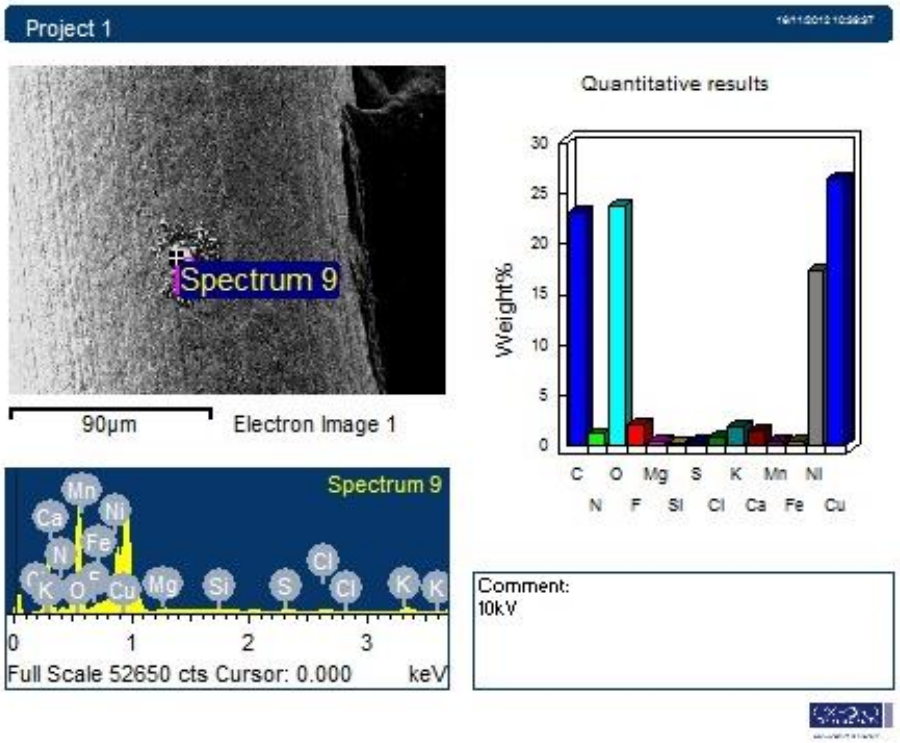




EDX results on several surface spots of a stainless steel rod after 60 minutes of ultrasounds stimulation (19 W).
During the experiment neutron bursts were detected.

Element		Weight %
C	**Carbon**	**19.80**
O	**Oxigen**	**29.27**
Na	**Sodium**	**1.20**
Mg	**Magnesium**	**0.19**
Al	**Aluminium**	**0.53**
Si	Silicon	0.49
S	**Sulfur**	**0.27**
Cl	**Chlorine**	**1.61**
K	**Potassium**	**0.54**
Ca	**Calcium**	**0.68**
Mn	Manganese	0.47
Fe	**Iron**	**44.45**
W	Wolframium	0.50

U. Mastromatteo, A. Bertelè, F. Celani; Hydrogen Absorption and Excess Heat in a Constantan Wire with Nanostructured Surface; J. Condensed Matter Nucl. Sci. 15 (2015) 240



EDX on one of several hot spots detected on the constantan wire. Elements not in the wire composition are:

C, N, O, F, Mg, S, K, Cl, Ca

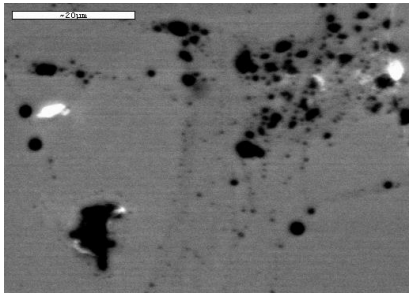
V. Violante, E. Castagna, S. Lecci, G. Pagano, M. Sansovini, F. Sarto, "RF detection and anomalous heat production during electrochemical loading of deuterium in palladium", Energia, Ambiente e Innovazione, Vol 2-3, pp. 63-67, 2014.

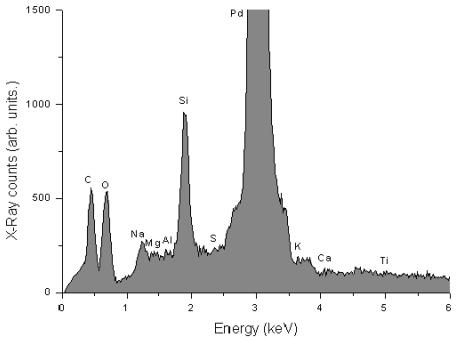
REMARKS

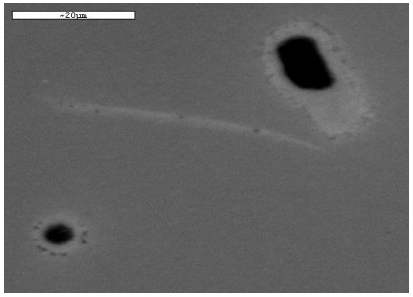
- RF was detected at the cathode during the test
- Anomalous heat was produced
- Then, EDX on three suspected contaminated areas of the Pd cathode after electrolysis highlighted the following elements:

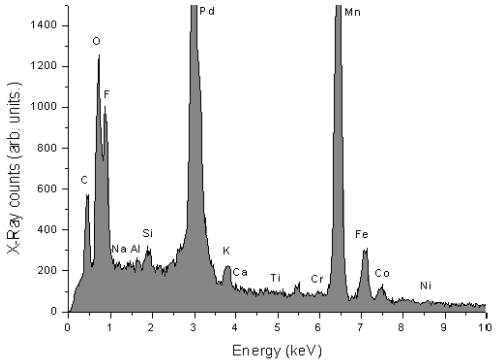
C, O, F, Mg, Al, Si, Ca, Cr, Fe, Ni

V. Nassisi et al., Modification of Pd–H_2 and Pd–D_2 Thin Films Processed by He–Ne Laser; J. Condensed Matter Nucl. Sci. Vol. 5 , pp. 1–6, 2011.









H_2 no LASER	H_2 LASER	D_2 no LASER	D_2 LASER
Si	Si	Si	Si
Pd	Pd	Pd	Pd
Ti	Ti	Ti	Ti
	C	C	C
	O	O	O
	Na	Na	Na
	Mg	Mg	Al
	Al	Al	Cl
	P	K	K
	S	Ca	Mn
	K		Ni
	Ca		
	Cr		
	Mn		
	Fe		
	Co		
	Ni		

EDX on hot spots after LASER stimulation of Pd thin film in H_2 or D_2 atmosphere. Neutron emission in the Pd-D_2 system was observed in previous experiments

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He-Ne LASER experiments reactor and sample

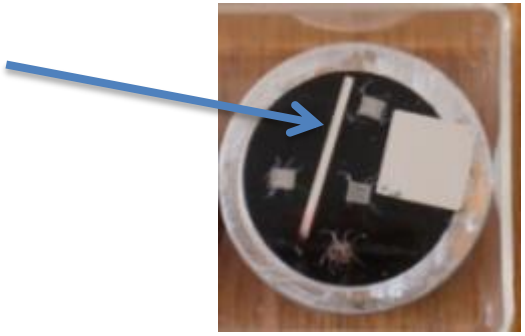
Photos of the reactor and the bottom part where the sample with the Palladium film will be placed

Oxidized silicon chip on which it is deposited a layer of palladium 250 nm thick; the size of the chip is: width 1mm, length 28 mm

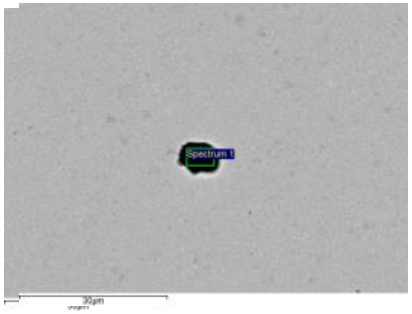
Test description

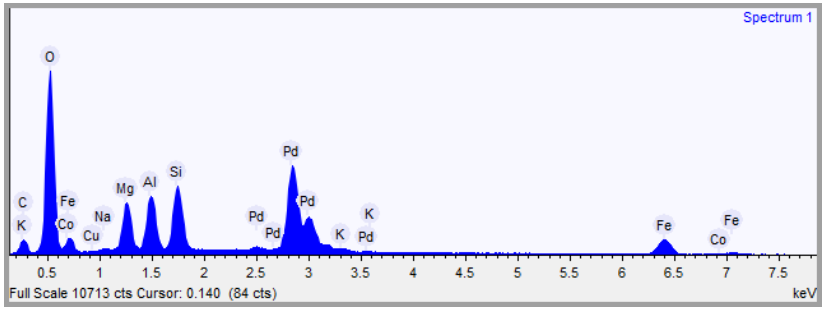
The sample shown in the picture below was inside the reactor for 2 weeks and irradiated through a glass viewport with a low power He-Ne laser (633 nm, 0.9 mW) at environment temperature.
An optical system was used to enlarge the laser spot up to 1 cm^2 size.
The Palladium surface was then accurately explored with a SEM to find possible traces of morphological changes: several cavities were found looking like similar findings of previous experiments.
Picture and EDX analysis follows.

The small silicon rod covered by palladium thin film (250 nm) estracted from the reactor and placed on the SEM and EDX sample holder

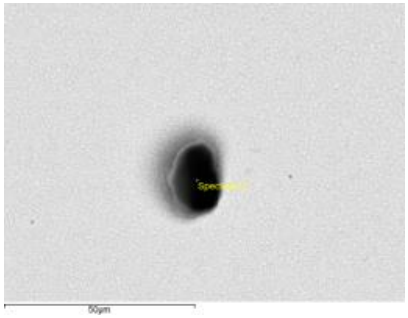


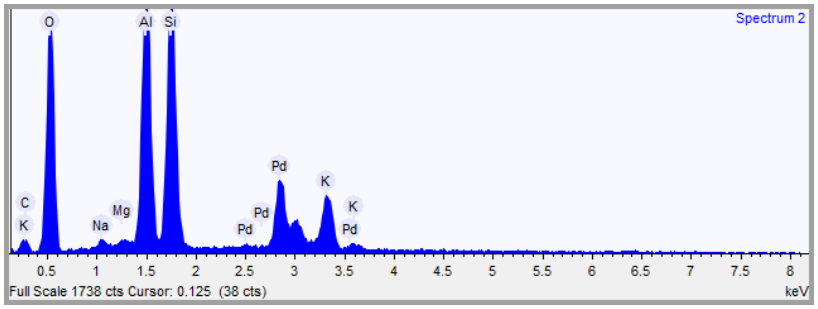
Irradiated Pd film cavities EDX analysis



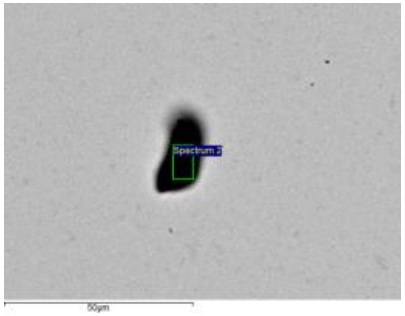


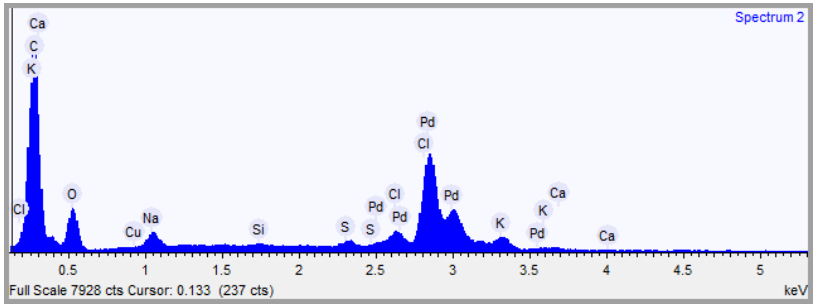
C
O
Na
Mg
Al
Si
K
Fe
Co
Cu





C
O
Na
Mg
Al
Si
K





C
O
Na
Si
S
Cl
K
Ca
Cu

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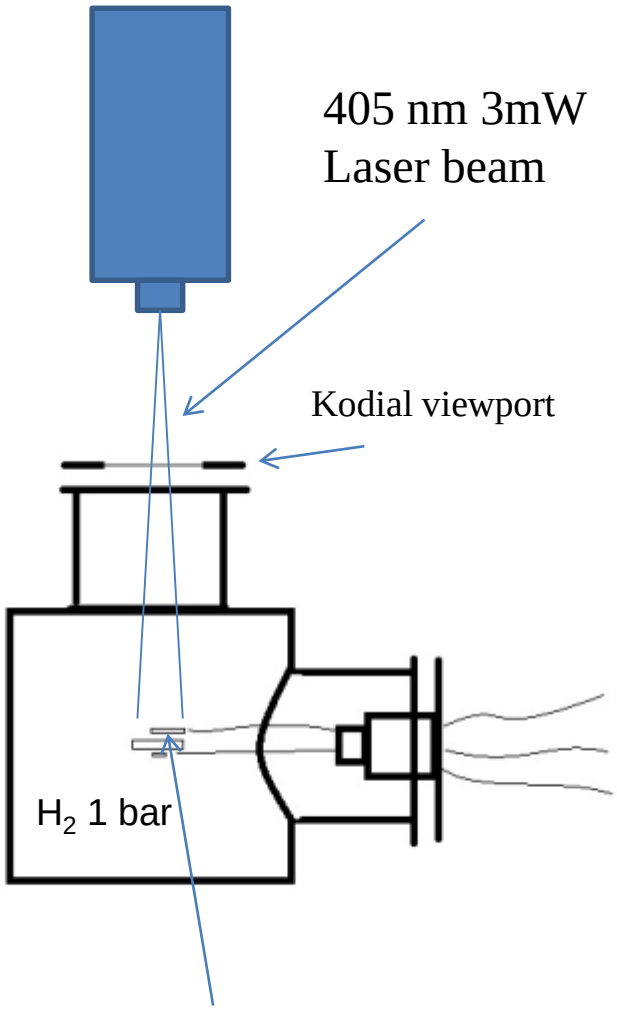
405 nm wavelength LASER experiments

- Another experiment was conducted on a square silicon chip (1 cm^2) covered with the same thin palladium film (250 nm) of the previous tests, but now irradiated with a solid state LASER, 405 nm, 3 mW, widening the spot of the beam to about 1 cm^2. After two weeks of irradiation, the sample was extracted and examined by SEM and EDX analysis using an Hitachi TM 3030 system. Also in this case, exploring carefully the surface of the palladium, several cavities have been found on which the EDX analysis was conducted.

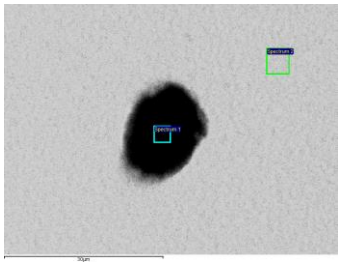
Experimental set up sketch

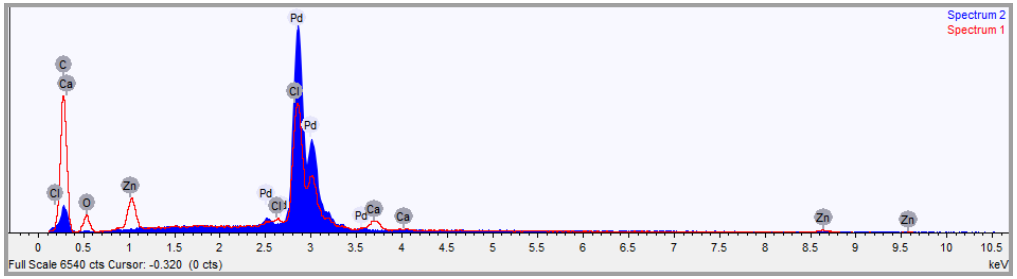
Laser spot



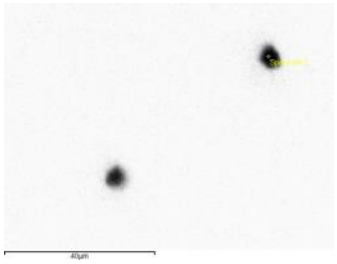
1 cm^2 Pd thin film sample

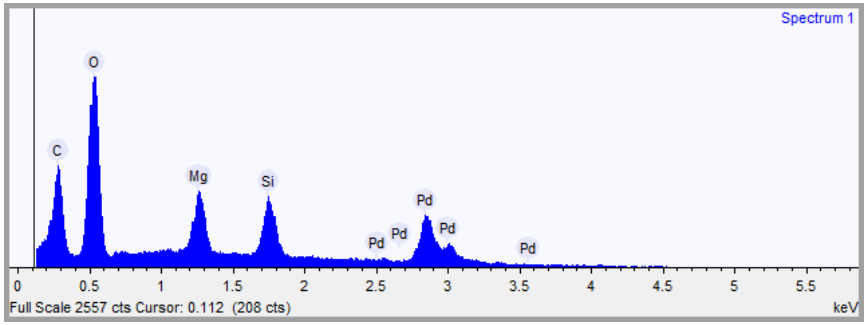
Affected surface EDX analysis



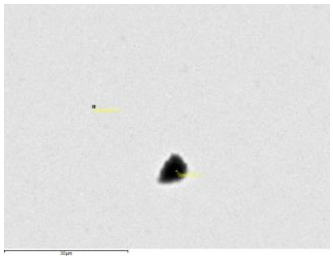


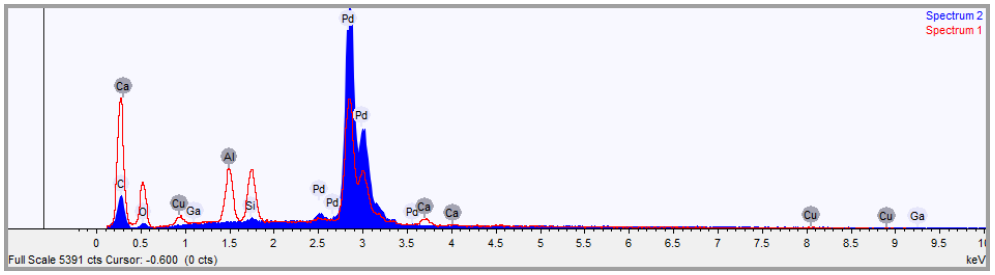
C
O
Cl
Ca
Zn





C
O
Mg
Si





C
O
Al
Si
Ca
Cu

EDX cumulative elements list

SEM explored area

C
O
Na
Mg
Al
Si
S
Cl
K
Ca
Fe
Co
Cu
Zn
Mo

H_2
LASER
Si
Pd
Ti
C
O
Na
Mg
Al
P
S
K
Ca
Cr
Mn
Fe
Ni

EDX elements cumulative list in: (V. Nassisi et al., Modification of $Pd–H_2$ …….)

Final remarks

- The experiments shown confirm previous findings although to a lesser extent (duration two weeks instead of 10 weeks);
- The 405 nm solid state LASER appears less effective than the 633 nm He-Ne one;
- Continuous monitoring for neutrons and gamma emission never registered deviations from the background spectrum;
- An accurate analysis of samples not irradiated did not show the presence of cavities with the elements found in the samples tested.

Conclusions and future activities

- The experiments cited as background indicate the presence of transmutations similar to those shown in this presentation, often associated with other anomalies LENR such as emission of neutrons and excess heat generation;
- Induced oscillations in the material, by ultrasound, radiofrequency, LASER radiation, sometimes appears essential for the occurrence of the anomalies;
- Since some elements attributable to transmutations can easily come from environmental contamination (Na, Si, Al, Mg, Ca..), we plan to replicate controls on the samples with accurate SEM analysis before the LASER treatment in the reactor.

Thank you for the attention