Figure 4. The Pd cathode after few hours of operation in the cell

The NUCLEAR project has been conceived just to overcome these problems: a new cell has been designed and realized reducing the overall mass. On both sides the reactor is enclosed by two symmetric flanges equipped with an optical window. One window is set with a quartz window for IR measurements while the other would host an X-ray detector. (Fig. 5).

Figure 5. Lateral view of the cell

The most challenging task will be to set up a procedure to realize a compact sandwich where the electrodes (cathode and anode) are directly deposited onto the PEM in order to avoid protons-electrons recombination, and subsequent loose of energy. Beside Nafion we also plan to use ceramic proton conductors operating between 80 and 400 °C.

3. CONCLUSIONS

The NUCLEAR Project is aimed to perform a critical review of experiments which, in the past decades, have shown the existence of thermal emission during the interaction between hydrogen (deuterium) and hydrated (deuterated) metals such as palladium or nickel. In particular, the analysis of the literature has shown that in the most of the successful experiments, the following conceptual block diagram has been followed:

a) Hydrogen (deuterium) ionization. Hydrogen (deuterium) molecule is splitted onto the surface of a catalyst such as Pt or Pd at room temperature or Ni at high temperature (> 280 °C) or is obtained by electrolysis of water.

b) Interaction with the lattice The atomic hydrogen (deuterium) is then loaded into a lattice where it migrates as a proton (deuteron) and form an hydride (deuteride). The loading is driven by an applied electric field. High loading ratios are obtained in suitably conditions.

c) During the process a flux of protons is assured across the target metal via a pressure or a temperature gradient.

This conceptual experiment can be realized in several way: electrolysis of (heavy) water, Cöhn-Aharonov effect [12], sputtering or co-deposition of protons (deuterons) and Pd on Pd bulk [13], high pressure flux through the hydride [14] and many others. However, the interaction of a flux of protons (deuterons) with a heavily hydride (deuteride) lattice is a basic feature of the successful experiments.

Thanks to the progress in the material science, and especially in the PEM knowledge and manufacturing, is possible to overcome many of the problems which affected the experiments in the past decades. These considerations allows to envisage a new approach to simplify the experimental design and remove the irreproducibility of the results what has been the main obstacles to the acceptance of LANR by the scientific community.

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NOMENCLATURE

F	Faraday constant, $Cmol^{-1}$
R	Molar gas constant, $Jmol^{-1}K^{-1}$
T	Temperature, K