Steps to identification of main parameters for AHE generation in sub-micrometric materials: measurements by isoperibolic and air-flow calorimetry.

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Introduction. We have introduced since 2011 the use of Constantan wires ($Cu_{55}Ni_{44}Mn_{1,}$ CNM), treated to have a sub-micrometric surface texture with an enhanced capability to dissociate Hydrogen (H_2) and/or Deuterium (D_2) from molecular to atomic state. Key reasons for the introduction of CNM were: cost reduction of *active material* (i.e. Pd and its alloys); improvement of the durability of the material, wires (Φ=50-200 μm, l=50-200 cm) activated using pulse heating (ultra-fast cycles from room temperature to 900 °C), and loading/unloading of Hydrogen or Deuterium.

Reactor materials. The reactor body is made of thick borosilicate glass (Schott) working up to 500°C; gas pressures (pure H_2, D_2 or mixed with noble gas Ar, Xe) between 0.05-3 bar. Since 2015 we have used, in the reactor, 3 wires of 125 cm length: Pt (ϕ=100 μm) used both as local thermometer and for calibrations; "standardized" CNM (ϕ=200 μm); "explorative" CNM wire (different ϕ, l, number of wires, thermal pre-treatments, coating, ...). All wires, except Pt, were initially treated with a series of high power electric pulses (up to 50 kVA/g ➔ 900 °C) in order to modify the dimensionality of smooth surface to sub-micrometric by oxidation, following the pioneering work of Y. Arata (Osaka Univ.) on nanomaterials. The specific surface increased thousand times as well as the efficiency of CNM as catalyzer of H_2/D_2 dissociation. Moreover, the surface is several times coated with Low Working Function materials (mainly SrO), according the intuitions/tests of Y. Iwamura (MHI, Yokohama) about the role of electron emission in LENR field. Each wire is inserted into glassy multi-filamentary sheaths, also impregnated by liquid solutions [$Sr(NO_3)_2$, $Fe(NO_3)_3$, $KMnO_4$; later decomposed to oxides], in order to reduce the drawback of sub-micrometric material detaching from wire surface. The borosilicate has the peculiarity of adsorbing large amounts of H (1927, I. Langmuir). Finally, we also made several knots (hole<0.1 mm) along the CNM wires to get non-equilibrium conditions due to the local thermal gradients and high magnetic fields (flowing current up 2.5 A, FexOy magnetism).

Results. In previous experiments we have evaluated AHE (anomalous heat energy) using an isoperibolic procedure being the most appropriated to produce *non-equilibrium conditions* in the system (thermal gradients in this case), as observed by several Researchers in the field. This allowed to measure gains near a factor 2 in the experiments at the highest temperature, although with limited stability over time. Recently, we have decided to compare previous results obtained from the isoperibolic approach with an air flow-calorimetry. During the new experiments, the external wall of the glass reactor has been covered with a double layer of black and thick aluminum foil to further homogenize the internal temperature. The calorimeters consist in a large insulating Styrofoam box with a layer of thick aluminum foil covering the internal surface for improved thermal homogeneity. The calorimeter assembly contains the active reactor and a W lamp inside a dummy reactor for calibrations; these are performed powering the lamp (0->120W->0W, step 20W). Best results to date are the following: A) with a CNM wire with ϕ=100 μm D_2 at 1 bar, internal reactor temperature 500°C, input power 90W the AHE was over 12 +-2W, i.e. over 150W/g, but after 1 day the wire was broken; B) with a CNM wire with ϕ=200 μm it has been necessary to have a Xe-D_2 mixture (each 0.1 bar) and input power of 120 W in order to obtain an AHE of 6-7 W stably for weeks. Qualitatively, such results, and dynamics, where observed twice with 2 different set of wires. It is worthy to note that the behaviors of thin wires was even similar to quite old experiments (50 μm Pd wires): sadly most of the documentation of our old experiments were destroyed by some people at LNF on Feb. 2015. Further work is necessary to improve reliability of the (nice) results (AHE=150W/g; integral of energy over 10MJ/g) obtained by 0.1mm wire.