Observation of macroscopic current and thermal anomalies, at HT, by hetero-structures on thin and long Constantan wires under H_2 gas.

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Since the end of 2011 we introduced, in the LENR research field, a Copper-Nickel alloy, named "Costantan" (ISOTAN 44, Isabellenhutte-Germany; usual composition, mass components %: $Cu_{55}Ni_{44}Mn_1$) in the form of long (l=100cm) and thin (Φ=100-200μm) wires. We rediscovered that such alloy, at nano/micrometric dimension and at high enough temperatures (>120°C), catalyzes the dissociation of H_2 to 2H and absorb/adsorb protons in the lattice. In order to increase the catalytic proprieties, the wires were subjected to specific thermal and electric treatments that create sub-micrometric and multilayered nanostructures, vaguely similar to hetero-structures.
Some of the results obtained, using a simple dissipation reactor made of a thick-wall *Boro-Silicate Glass (BSG)* tube, were quite reproducible and the Anomalous Heat Effect (AHE) detected (at Constantan wire surface temperatures of 160-400°C) was about 5-10W with 50W of electric input power [ICCF17, August 2012, Daejeon-South Korea]. Later on, we realized that the overall reproducibility was not satisfactory as observed in the first series of experiments.
Using SEM/EDS (and ICPMS) analysis we found, among others, that the first batches of raw material used (produced before 1970) had a composition different from more recent ones. The main difference was Fe contamination, in the order of 1000-5000 (and up to 10000 locally) PPM.
We found that even the *BSG fiber sheaths* (SIGI-Italy), largely used in our experiments as electric insulator, could have some role in AHE generation. In short, hydrogen eventually dissociated by the Constantan wire, is largely adsorbed into the surface of the micrometric (Φ=5μm) braided fibers. Such BSG property was observed by Nobel Laureate Irving Langmuir since 1920. The amount of adsorbed H, at low temperatures, was in the order of 10^{15} atoms/cm^2.
In our experiment the effective surface of each sheath is >1m^2. The total amount of fiber used may have a total surface > 50m^2. We realized that such BSG property may enhance the absorption of Hydrogen in Constantan lattice and related AHE. [F. Celani et al: "MIT-2014 Colloquium on Cold Fusion Effects", March 21-23, 2014; Cambridge-USA].

In a typical setup we have a Platinum wire (Φ=100μm) used mainly for calibration purposes ("reference") and two Constantan wires (the "active") with different diameters (100, 200μm) and/or surface treatments. We can control only two wires at same time. For this reason one of Constantan wires is not acquired by the DAQ (PIXIe, NI) and is left unconnected (floating), but periodically his resistance value is measured by a general-purpose multimeter to evaluate the presence of absorbed Hydrogen. We observed that the wire resistance decreases (up to values as low as 70% of initial one, the so-called R/Ro ratio), when the Constantan wire is heated in presence of Hydrogen.

On June 25, 2014, we noted that Constantan wire generated a macroscopic voltage (>>0.100mV), that is function of many parameters (e.g.: temperature, gas type and pressure, value of R/Ro). We observed that it generated, with good reproducibility, currents up to 120μA and voltages up to 1500μV.
Finally, taking into considerations our old results (2012) we developed a new procedure to add Iron, at nanometric dimensions, over the surface (and even into the bulk, some microns) of Constantan wires during the several preparation steps. The Fe is one of the few elements characterized by a solubility of H inside lattice that *increases*, largely, *increasing* the temperatures (from 0.37cc/100g at 400°C to over 7cc at about 1000°C). With this procedure 20-40 Fe layers may be created, like heterostructures. Moreover, we introduced, local, geometric variation of the current paths injected inside the wire by making several (up to 20), low diameter (1-2mm) knots: even magnetic effects are expected. Recent experiments with/without Fe and knots, and their combinations, show that such new setup could have measurable advantages from the point of view of Hydrogen absorption and AHE values.