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Peculiarities of hydrogen interaction with Ni powders and melt spun $Nd_{90}Fe_{10}$ alloy

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Hydrogen interaction with Ni powders has provoked a lot of excitement and controversy due to the works of Rossi, Parkhomov and others, who claimed to produce excess heat in their experiments that could not be explained by conventional chemical reactions [1]. Yet, there is no reliable 100% evidence of the effect up to date, and some of subsequent experiments produced less [2] or *zero* [3, 4] effect as their measuring accuracy increased. Unfortunately, the claimed evidence often depends on indirect calorimetry methods and as such it does not produce an ultimate proof. We present an experimental setup that allows accurate measuring of the main parameters controlling the reaction: hydrogen pressure, temperature inside the fuel and at the heater, the difference between which can provide direct evidence of the excess heat. Our program pursues two goals: (i) verify the previous results and (ii) test our facility in a wide range of parameters to be used in experiments with novel types of fuel that we plan to create in future.

One of the new materials tested in our reactor was a melt spun $Nd_{90}Fe_{10}$ alloy with a large degree of amorphous or quasicrystalline phase. A fierce exothermic reaction was detected in $Nd_{90}Fe_{10}$ films upon filling them with *hydrogen* or *deuterium* and heating up to ~300 C, which resulted in the melting of the samples and the Cu foil, in which the samples have been wrapped. Quantitative analysis have shown that the amount of heat produced in large $Nd_{90}Fe_{10}$ samples in our experiments is 80÷100 kJ per g of hydrogen, which is an order of magnitude higher that that recorded by a differential scanning calorimetry method in small $Nd_{90}Fe_{10}$ samples in the same temperature range. Possible reasons for the discrepancy are discussed including low energy nuclear reactions taking place at the *initial stage* of hydride formation when 80÷90% of the material is in amorphous or quasicrystalline phase that facilitates the energy localization, which triggers LENR as has been argued in refs. [5-8]. Subsequently, the disordered phase transforms to crystalline hydrides NdH_2 and $Nd_2Fe_{17}H_{4.8}$ (observed by XRD analysis), where the energy localization becomes more difficult, which stops the LENR.

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