Nuclear fusion in solids – experiments and theory

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Experiments about low temperature nuclear fusion in several metals (including Pd) have been performed and new theory providing explanation of the observed results has been developed. The results are presented in this paper.

The experiments were performed in vacuum chamber in order precise measurements to be achieved and due to the relatively low concentrations of the interacting gases the amounts of the generated helium and of the generated energy (heat) were relatively low. In fact D_2 gas in environment of H/H_2 gas in the chamber was directed to metal sample placed on sample holder and generation of both ^{3}He and ^{4}He was observed in all experiments as it was supported by the following facts: *i)* Mass analysis shows relatively high amount of ^{3}He; *ii)* Mass analysis shows relatively high amount of ^{4}He/D_2 and relatively significant amount of ^{4}HeH that confirms relatively high amount of ^{4}He; and *iii)* DC plasma spectroscopy shows peaks typical for both ^{3}He and ^{4}He. The experiments were carried out in two modes – without plasma and with plasma containing both deuterium and hydrogen ions. In the second mode the kinetic energies of both D and H ions were determined and it was found that the amounts of both ^{3}He and ^{4}He increase with increase of these energies. It was found that the pressures of both ^{3}He and ^{4}He increase with increase of the deuterium pressure. (Graphics of ^{3}He vs. D_2 for both plasma mode and no-plasma mode are provided in Fig.1.) The temperature of the sample holder was measured during the experiments and cyclic dependence on the time was found (Fig.2) and also it was fond that this dependence correlates with changes in the amounts of both ^{3}He and ^{4}He in the time. In some experiments external heating of the sample holder was performed in range 100^0C-700^0C and it was found increase of the amounts of both ^{3}He and ^{4}He with increase of the temperature. Radiation (including gamma rays and neutrons) was measured in all experiments and no increase of the radiation above the normal background was found. (Absence of increase of the radiation is due to either: *a)* The low amounts of gases used in all experiments gives a radiation, which is very small and cannot be detected by the used devices; or *b)* These is no radiation at all due to the low kinetic energies of the interacting D and H nucleus in solids.)

The experimental results provided above are explained with new developed quantum mechanical theory based on interaction of both D and H nucleus with heavy electrons that are localized in solids. The theoretical outcomes are consistent with the above experimental results and they provide proof that two nuclear fusion schemes in solids have places: *i)* D+H→^{3}He+energy; and *ii)* D+D→^{4}He+energy. Also the theory explains increase of the amounts of both ^{3}He and ^{4}He with increase of the temperature of the sample and with increase of the kinetic energies of both D and H nucleus. The theory is valid for all solids, however it determines that the above nuclear fusion reactions can have places only in solids having certain properties. (Pd metal is one of these solids.)

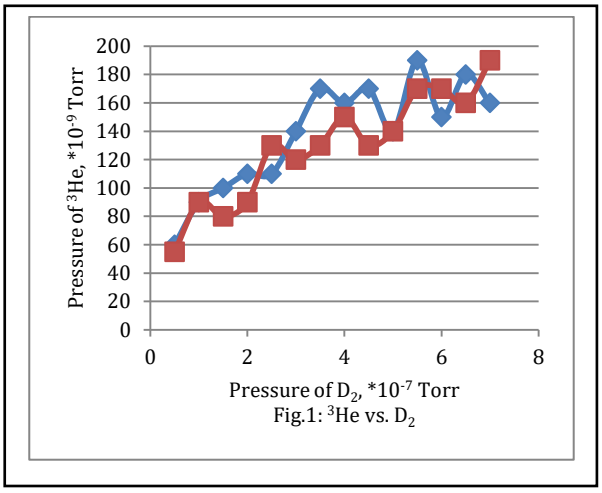

Fig.1: ^{3}He vs. D_2

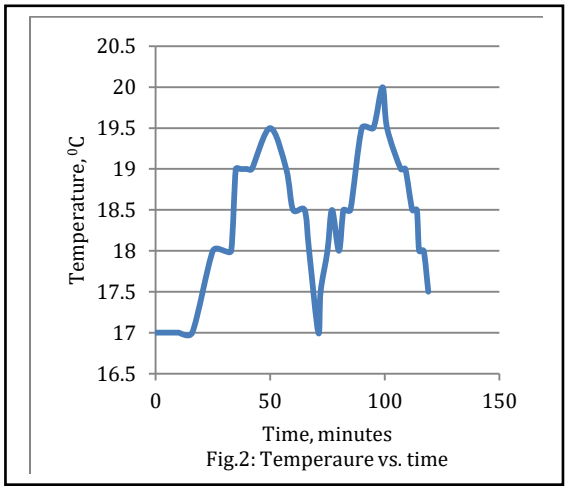

Fig.2: Temperaure vs. time