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Absence of neutron emission during interaction of deuterium with metal at low energies

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Abstract. Technique and instrumentation to detect reliably, multiplicity of neutrons emitted in sharp bursts ($\leq 100\,\mu$s) has been developed where a burst of as low as 15 neutrons and continuous emission of $\simeq 10^{-1}$ neutron/s may be detected. Using this technique, attempts were made to detect neutron emission from various experiments in which anomalous nuclear effects (or what is commonly referred to as cold fusion) may be expected to occur. No neutrons, above our detection threshold, were detected in the recent series of experiments.

Keywords. Anomalous nuclear effects; cold fusion; deuterated solids; burst neutrons; pulsed neutrons; neutron detection.

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1. Introduction

Several investigators, including the present authors [1, 2], have reported on the emission of neutrons when deuterium is loaded into palladium or titanium by electrolysis or by other techniques [3–16]. These experiments are usually referred to as anomalous nuclear effects in deuterium-solid systems or cold fusion. The neutrons were reported to be emitted continuously, as well as in sharp bursts presumably by the D–D fusion reaction

$$^{2}\mathrm{D}_1 + {}^{2}\mathrm{D}_1 \rightarrow {}^{3}\mathrm{He}_2 + {}^{0}n_1(2.45\,\mathrm{MeV}), \tag{1}$$

where $^{2}\mathrm{D}_1$, $^{3}\mathrm{He}_2$ and $^{0}n_1$ are deuteron, helium-3 and neutron respectively.

2. Neutron detection systems

In order to confirm and understand the nature of observed neutron emissions, simple, relatively inexpensive and high sensitivity systems had been developed [17] in two configurations, to characterize the burst and continuous neutron emissions. These detection systems were designed and optimized based on neutronics numerical simulations [18] and then through experiments. Hydrogenous materials (epoxy and polyethylene) were used to thermalize, back scatter and stretch ($\simeq 100\,\mu$s) the neutron burst. The thickness of hydrogenous material (to thermalize the neutrons), between experiments and detectors was $\simeq 2.5 \times 10^{-2}$ m. Typically 1.5×10^{-1} m of hydrogenous