

Energetic Particles Generated in Pd+D Nuclear Reactions

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Abstract

Low energy nuclear reactions (LENRs) are now believed to be one of the best future energy sources – clean, cheap and sustainable. In addition, the LENR energy is also the only solution to solve all the environmental problems, such as the greenhouse effects, environmental destructions and the heavy air pollutions happened recently in China.

CR-39 plastic nuclear track detectors (PNTDs) are the most useful nuclear track detectors in physics research. An important physical quantity in CR-39 work is the linear energy transfer (LET) - the linear density of energy lost by a charged ionizing particle traveling through matter, with units of keV/μm or MeV/cm. LET depends on the nature of the incident particle and the material traversed and governs the characteristics of the nuclear track in CR-39 detector. CR-39 detectors are sensitive to high LET particles (≥ 5 keV/μm water) and can measure charged particles directly and neutrons through secondary charged particles. The LET spectrum method using CR-39 detectors is so far the best one for high-LET particles research. Therefore, CR-39 PNTDs have been used for investigation on condensed matter nuclear sciences (CMNSs), including LENRs.

The former US Navy group and Tsinghua group conducted Pd+D experiments successfully and accumulated abundant experimental data recorded with CR-39 detectors. However, so far the physical results for the Pd+D nuclear reactions presented and/or published are mainly focused on the photos of nuclear tracks in CR-39 detectors and the statistics for the track parameters. Those approaches are important but can not provide the fundamental physical quantities – charge, energy and energy loss for each particle measured. Strict quantitative methods should be introduced for the data analysis of LENR particles. So far, the advanced LET spectrum method employing CR-39 detectors is definitely the best solution to obtain strict quantitative results for LENRs experiments. Any reliable LENR theories, reactors and products related to LENR energy can be obtained only based on the solid fundamental experimental research of LENRs. Therefore, it is a significant task for analyzing the Navy group's original data of LENRs using LET spectrum method.

This paper introduces the LET spectrum method using CR-39 detectors and the analysis procedures for the original data recorded with CR-39 detectors by the former Navy group, presents main results on LET spectra and charge distributions obtained using LET spectrum method, discusses the experimental spectra and the observed phenomenons, including the triple alpha particles generated by high energy neutrons produced in LENRs. The generation of high energy neutrons is a strong evidence of nuclear reactions. Novel methods and detectors for LENRs research are also discussed.

Key words: LENR particles, CR-39 detectors, LET spectrum method, LET spectra for Pd+D experiments