Review of Muon-Catalyzed Deuterium-Tritium Experiments

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The development of muon catalyzed dt fusion experiments is reviewed. The measurements performed in the eighties established a very fast kinetic cycle with yields exceeding 100 deuterium-tritium fusions per muon in D-T mixtures of high density [1, 2]. Rates of meso-molecular $d\mu t$ formation were evaluated growing strongly with temperature and indicating large resonances at epithermal μt energies. These observations were corroborated by theory [3] and raised hopes of achieving enhanced fusion outputs - interesting for energetics.

On the other hand, effects of muon sticking to the α fusion product seem to limit stringently the fusion yields. For some time conflicting data were presented which made the sticking question to be a controversial issue. The situation was clarified when direct experimental observations of $\mu\alpha$ sticking became available [4]. A sticking factor $\omega_s \sim 0.5\%$ emerged setting a rigid limit at 200 fusions per muon.

The highest directly measured yield still is 124 dt fusions per muon observed 1987 at PSI using a solid non-equilibrated D_2-T_2 mixture at 12 K [5]. Technical limits (high densities and temperaturs as well, leading to extreme pressures) make it very difficult to exceed the PSI result.

Ongoing and future experiments in H/D/T mixtures using improved experimental methods are directed to investigate the deuterium-tritium fusion cycle at conditions not explored yet in the past. The state of the art will be discussed and an outlook presented.

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