Cold fusion results from BARC*

Investigations of cold fusion phenomena carried out at Trombay during April–June 1989 have positively confirmed the occurrence of d–d fusion reactions in both electrolytic and gas-loaded Pd and Ti metal lattices at ambient temperatures. Neutron emission has been observed even when the current to the electrolytic cell is switched off or, in the case of gas-loaded Ti targets, when no externally induced perturbation, such as heating, cooling, evacuation, etc., is effected. The main findings of the Trombay investigations to date may be summarized as follows:

(i) Tritium is the primary product of cold fusion reactions, notwithstanding the fact that the tritium, if any, entrapped inside the palladium electrodes has yet to be quantitatively assessed. Thus cold fusion may be characterized as being essentially 'aneutronic' with a neutron-to-tritium channel branching ratio of less than 10^{-8}.

(ii) Neutron emission from both electrolytically loaded Pd and gas-loaded Ti is basically Poisson in nature, i.e. the neutrons are emitted one at a time. However, it is not clear whether the neutrons are generated in the d–d fusion reaction itself or are produced in a secondary reaction involving the energetic protons or tritons. In this context it would be of interest to look for the possible presence of 14 MeV neutrons in cold fusion experiments.

(iii) Occasionally nuclear events do appear to take place in which over a hundred neutrons are generated in a single sharp burst. Viewed in the light of the branching ratio estimate of 10^{-8} noted above, this leads to the intriguing conclusion that a chain reaction involving as many as 10^{10} fusion reactions occurs within a time span of 100 μs.

(iv) Autoradiography of gas-loaded Ti targets demonstrates in a simple and elegant manner not only the occurrence of cold fusion, but also the production of tritium. The estimated tritium-to-deuterium isotopic ratio in these targets is several orders of magnitude higher than in the initial stock D_2O and as such cannot be explained away on the basis of preferential absorption of tritium by the titanium, as may be suspected. The existence of highly localized regions (hot spots) on the target surface where tritium is concentrated, as well as the occurrence of spots all along the periphery of the Ti disc, point to the important role of lattice defect sites in the absorption process, or in the accumulation of tritium following migration after its formation, at least in titanium.

The very high probability for the tritium branch in cold d–d fusion reactions would indicate processes of neutron transfer across the potential barrier as postulated by Oppenheimer[1] over half a century ago and elaborated on more recently by Rand McNally[2]. If neutron transfer as envisaged by these authors does take place so easily, it may have many implications for the future of nuclear technology, for the deuterium nuclide might very well do the work that free neutrons do in present-day fission reactors. In the context of the emerging energy production scenario, aneutronic fusion reactions such as this may give rise to new fusion technologies, providing a cleaner energy source for the twenty-first century.

1. Oppenheimer, J. R. and Philips, M., *Phys. Rev.*, 1935, **48**, 500.
2. Rand McNally, Jr, J., *Bulletin of APS*, Baltimore Meeting, April 1983.

P. K. IYENGAR

Bhabha Atomic Research Centre
Trombay
Bombay 400 085

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