# Thorium Utilisation in Accelerator Driven Systems

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The current interest in Accelerator Driven Systems (ADS) can be traced back to the energy amplifier proposals of the CERN group for producing energy using thorium fuel. Programs were drawn up in several countries for developing accelerator driven systems. In recent years, however, much of this activity has been focused towards developing ADS for waste transmutation. In India however, there continues to be interest in utilising thorium by the ADS route. A roadmap was drawn up several years back for developing ADS in India. This involved a major program for developing a high current high energy proton accelerator, a program for target development and a research program in the area of the Reactor Physics of ADS. The talk gives an outline of the ADS program in India and discusses various methods being studied for thorium utilization by the ADS route.

The accelerator program is oriented towards development of a 1 GeV proton accelerator with a 30 mA beam current. The first phase, presently under development, is a 30 mA, 20 MeV Linac (LEHIPA). The program for target development involves the setting up of a LBE loop for studies on the heavy liquid metal coolant. It also involves development of an experimental target for irradiation in the proton beam of the medical cyclotron at Calcutta. The reactor physics program includes development / induction of advanced computer codes and compilation of nuclear data required for analysis of ADS, and physics studies on various proposed designs of sub critical ADS for utilising thorium. It also includes an experimental program for studying the physics of sub critical ADS, including development of methods for sub criticality measurement and monitoring.

Among the studies on Th utilisation in ADS, one of the earliest proposals studied by us is the one way coupled fast-thermal ADS which permits operation of such an ADS at much reduced accelerator currents. Another concept proposed by us is the thorium burner for *in situ* breeding and burning of thorium fuel in a once through cycle. Both fast and thermal versions are discussed. The thermal thorium burning ADS has a low gain but the fast version seems attractive enough for further investigation. We also discuss the thermal ADS molten salt reactor concept which has a high breeding ratio and a short doubling time.

Finally we discuss the Th breeder ADS. This is a Pb cooled fast sub critical reactor, fuelled with a mixture of $^{233}U$ and thorium. The $^{233}U$ recovered from the discharged fuel is recycled in the reactor. The excess $^{233}U$ produced in the reactor can be used for setting up new reactors, and would contribute to growth of installed capacity.

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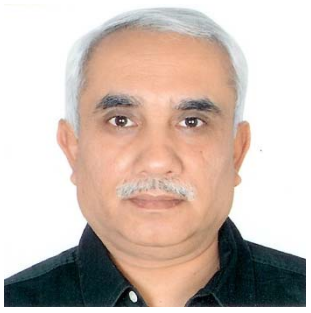

Dr. Shashikant Balwant Degweker joined the Bhabha Atomic Research Centre (BARC) in 1977 after graduating from the BARC Training School. He completed his PhD in the year 1993. Presently he is working at BARC as an Outstanding Scientist and is heading the Mathematical Physics and Reactor Theory Section. Dr. Degweker is also a Senior Professor at the Homi Bhabha National Institute. Dr. Degweker has worked in various areas of mathematical and computational Reactor Physics such as

Transport Theory, Monte Carlo, Diffusion Theory, Reactor Kinetics and Burnup. He has also worked in the areas of Accelerator Driven Systems (ADS), Th utilisation, and theoretical methods in Reactor Noise Analysis and Passive Neutron Assay. His other research interests include Molten Salt Reactors, High Temperature Reactors and Experimental methods in Reactor Noise and assay of nuclear materials.