Workshop on Advanced Reactors With Innovative Fuels

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ABSTRACT

European Collaboration on Research into High Temperature Reactor Technology

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Europe has a long history of innovation in High Temperature Reactor (HTR) systems. The HTR was first suggested here in the mid-1950s, and the first experimental units of both the prismatic and pebble-bed core designs were operated in the UK in 1966 in Germany in 1967, respectively. Recent years have seen considerable renewed world-wide interest in HTR systems, with new experimental reactors recently attaining criticality in Japan (HTTR) and China (HTR-10), and international programmes established for the design of modular HTRs, such as the PBMR and the GT-MHR. Within Europe, a number of collaborative R&D programmes have been established under the auspices of the European Commission's Framework-5 Programme, co-ordinated by a Technology Network (HTR-TN). This network now comprises 18 organisations from across 8 European countries, together with the EC's Joint Research Centre (JRC). The purpose of these programmes is to secure the wealth of historical European expertise in HTRs, and building on this knowledge, to further pursue the development of HTR technology in order to underpin it's eventual commercial application within Europe. Research programmes have been instigated in the following areas.

Fuel Technology (HTR-F). The initial programme of R&D on HTR fuel technology comprised activities on the compilation of historical fuel irradiation behaviour, the development of an analytical model for in-reactor fuel performance, the development of fuel manufacturing technology, and an irradiation experiment in which both German fuel spheres and American fuel compacts will be irradiated in the High Flux Reactor (HFR) at Petten to a target burnup of 200 GWd/tU. The EC has now also agreed to support a follow-on programme, aimed at performing post-irradiation examination of the fuel, including fault simulation studies in the Cold-Finger Apparatus (KÜFA) at the JRC's Trans-Uranium Institute.

Core Neutronics and Fuel Cycle Technology (HTR-N). This programme is divided into studies of HTR core physics and methods validation, including an assessment of the need for new nuclear data; analysis of alternative core designs and fuel cycles aimed for example at the burning of Pu and/or minor actinides; and assessments of HTR waste treatment and disposal, including long-term characteristics of coated particle fuels. The EC has also agreed to support a follow-on programme, allowing more detailed studies in this area.

Materials (HTR-M). Materials technology will be key to the success of the proposed modular HTR systems. In this programme, activities have been divided into four work packages: design and materials for the reactor pressure vessel; materials for high temperature applications (e.g. reactor internals, core support structure, turbo-machinery); properties of irradiated graphite; and graphite oxidation.

This paper will present an overview of the status of the 5th Framework HTR technology programmes, and will describe the principal results obtained to date.

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