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PERFORMANCE EVALUATION OF TIN OXIDE BASED SENSOR FOR MONIOTORING TRACE LEVELS OF H2 IN ARGON COVER GAS PLENUM OF FBTR

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Large volume of liquid sodium is being handled in primary and secondary coolant circuits in Fast Breeder Reactors (FBRs). In the steam generator section, sodium is separated from high pressure steam/water by a thin wall of ferritic steel. In the event of any sudden leak, high pressure steam/water comes in contact with liquid sodium resulting into sodium-water reaction. Such an eventuality needs to be detected in the incipient stage itself, in order to avert major sodium-water reaction that can otherwise cause excessive pressure-built up in the steam generator, apart from affecting reactor operation, since sodium-water reactions lead to the formation of hydrogen, NaOH, Na2O and NaH .

During the start-up and low-power operation of the reactor, the temperature of sodium is about 473 K, at which the dissolution of H2 in sodium is kinetically hindered. Thus, the hydrogen formed, will evolve in the argon cover gas over sodium. Hence, monitoring hydrogen concentration in argon cover gas will help detection of steam leak into liquid sodium at its inception. Thermal conductivity detector (TCD)-based detectors are reported to be the most promising on-line monitors for hydrogen especially in inert streams such as argon cover gas space of Fast Breeder Test Reactor (FBTR), Kalpakkam. However, their lower detection limit is reported to be about 30 ppm only. A sensor, which can sense below 30 ppm is preferable for identifying the release of trace levels of H2 in argon cover gas. Among various sensing materials, semi-conducting metal-oxides like SnO2, ZnO, etc., are promising materials for the detection of trace levels of hydrocarbons, hydrogen, carbon monoxide, etc. The working principle is the measurement of change in surface-conductivity of the metal oxide during the interaction with the analyte, which is directly related to its concentration. A thin-film based tin-oxide (SnO2) sensor was developed in our laboratory, which can sense between 1 and 100 ppm of hydrogen. This sensor was interfaced at the outlet of TCD based Hydrogen-In-Argon (HAD) system in the secondary-sodium circuit of FBTR; its performance was evaluated both during reactor shut-down condition as well as during power campaigns. This paper presents the details of these experiments and the results obtained.

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