Sergey Bazyuk, J Aeronaut Aerospace Eng 2014, 3:2
http://dx.doi.org/10.4172/2168-9792.S1.005

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Mechanical & Aerospace Engineering
September 08-10, 2014 Hilton Philadelphia Airport, USA

Data generalization of the quench front velocity and minimal film boiling temperature for model LWR fuel assemblies

Sergey Bazyuk
FSUE "SRI SIA "LUCH", Russia

Approximately 30 small accidents and 3 huge accidents have already happened in the world: Three Mile Island, Chernobylskaya, Fukushima Dai-Ichii. At present higher attention devotes to prevent accidents and detail analysis of NPP safety is carried out. The most severe consequences for people and the environment are the Loss-of-Coolant Accidents (LOCA) which are subdivided in the Design Basis Accidents (DBA) and Beyond Design Accidents (BDA). Nowadays LOCA of light water reactors (LWR) are prevented by water injection to reactor of bottom or top direction. This process is called re-flooding. The issue of optimal regime parameters for fuel assemblies (FA's) quenching of best performance during the reflooding of WWER-type and PWR-type cores is evident for predicting the evolution of DBA and BDA and to develop measures to provide nuclear safety. The re-flooding is simulated with the appliance of one-dimensional thermal hydraulics codes to determine the optimal regime parameters for fuel rod claddings quenching. The applications of CFD codes that model two-phase steam-water medium in FA under the conditions of subcooled liquid forced boiling are being developed. The closure equations for the minimal film boiling temperature (T_{MFB}) and quench front velocity (u_{fr}) are required for the development of quench models and their validation. The last ones can be obtained from the analysis of experimental data. The results of different reflooding investigations of model WWER-type and PWR-type FA's during DBA and BDA carried out at four electrically heated large-scale facilities - RBHT (PSU, USA), CODEX (AEKI, Hungary), SVD (IPPE, Russia) and PARAMETER (SRI SIA "LUCH", Russia) are presented and analyzed. These test facilities differ by the geometry and materials used to simulate FA's. Some of tests perform the ballooning and depressurization of fuel rods during the experiments. The range of regime parameters variations are: initial fuel rod cladding temperature -T_{clad} = 420 ÷ 1490 ^{o}C, water mass velocity - pw = 0.14 ÷152 $kg/(m^2.s)$, inlet liquid subcooling to model FA -ΔT^{in}_{sub} = 11 ÷ 125 ^{o}c, system pressure -p = 0.14 ÷ 0.42 MPa, linear heat flux, simulating decay heat q1 = 0 ÷2.3 kW/m. The experimental data have been analyzed (containing up to 760 points) and the correlations for predicting the T_{MFB} and u_{fr} are proposed in dimensionless form. The proposed closure equations were validated on the experimental data obtained at large-scale SEFLEX (FZKA, Germany) facility.

Biography

Sergey Bazyuk has completed his Masters Degree in the field of thermal physics at the age of 22 years from Moscow Power Engineering Institute (Technical University) and PhD studies from FSUE "SRI SIA "LUCH". He is the Chief of Laboratory of FSUE "SRI SIA "LUCH", the company that belongs to Russian State Nuclear Corporation ROSATOM. He has published more than 12 papers in reputed Russian and international journals.

bazukss@inbox.ru