investigated cases are categorized into uranium oxide, uranium-thorium oxide, thorium-plutonium (weapon and reactor-grade) oxide, and thorium-uranium-plutonium oxide mixtures. The inventory of fissile components ranges from 2.5 to 50%. The metrics for the judgment include the burnup level, fissile fuel utilization, conversion ratio, concentration of long-lived transuranium elements, radiotoxicity at the end of life, and reactivity coefficients. Furthermore, in order to reduce initial excess reactivity in cases with high concentrations of fissile isotopes, the application of a layer of burnable poison ZrB_2 coating on fuel cladding and its optimum thickness were also investigated. Calculations show that the application of thorium generally improves the neutronic performance of the fuel compared to pure uranium oxide fuels with the same level of fissile inventory. Moreover, while the burnup level and duration of fuel campaign peaks in uranium-thorium mixtures and uranium-weapon-grade plutonium mixture, the former have a better fissile fuel utilization and negative feedback of reactivity, and the latter benefits from the lower growth rate of transuranium elements relative to the beginning of life (BOL).

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TURBULENCE MODELS FOR NUMERICAL SIMULATION OF TEMPERATURE DISTRIBUTION IN SCWR

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In the present study, Computational fluid dynamics (CFD) simulation was conducted for 2×2 rod bare bundle using water at supercritical pressures. Main objective of the simulation is to compare calculation results with varying temperatures. CFD simulation was performed to replicate the results from the experiment of heat transfer to supercritical water in 2 × 2 rod bundle conducted at Shanghai Jiao Tong University [1]. This report presents the results to assess capability of the commercial CFD software Ansys fluent in simulating the convective heat transfer of water at supercritical pressures in nuclear fuel rod. The type of flow for simulation is taken as steady state flow. The mass flux is 800 kg/m2s and the heat flux is 600 kW/m^2. The experiment was performed for the pressure of 25 MPa The temperature varies from 300°C, 340°C and 380°C. This simulation is conducted for steady state i.e. all the physical properties of water such as density and viscosity are considered as constant .K-epsilon turbulence model is used for our CFD simulation. K-epsilon model gives better results when there is mixing in the fluid flow. Solutions methods and scheme used for our investigation are provided in the table below.

Table 1. Solution methods

Solution method	Scheme	Solution method	Scheme
Pressure	simple	Energy continuity equations	2nd order Upwind
Pressure-velocity comp.	simple	Gradient	Least square cell based
Momentum equations	2nd order Upwind	Turbulent & kinetic energy equa.	2nd order Upwind

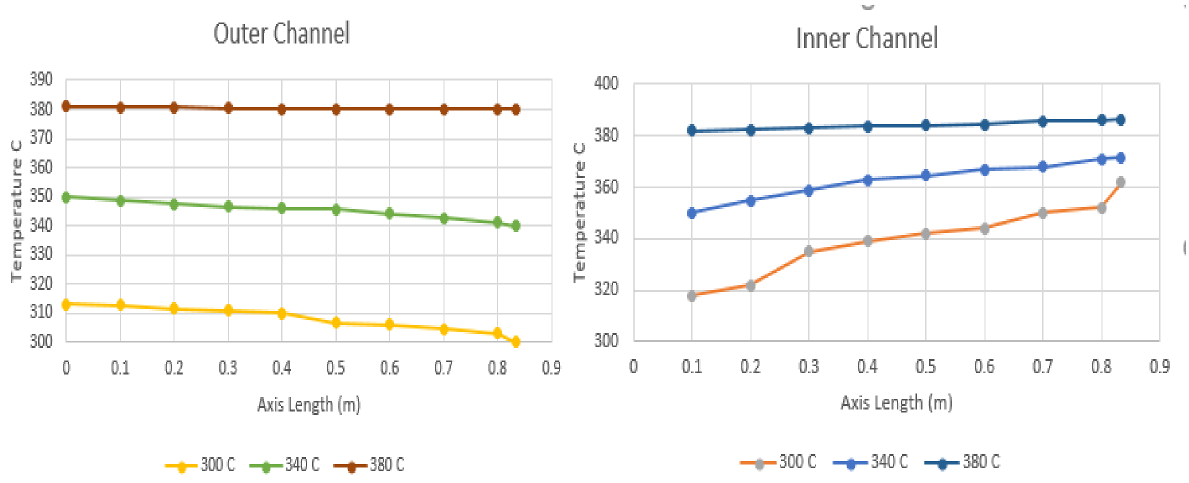

Fig. 1. Dependence of the coolant temperature at 300°C, 340°C , 380°C on the channel length

The results obtained from CFD simulation comes in close agreement with the experimental data as shown in Fig 1. Temperature is plotted along the radial length for inner and outer channels. The graph obtained is compared with the experimental results. All three turbulence models give results in acceptable range closer to the experimental data (5-10) %. The results were obtained for three inlet temperature of 300 °C, 340°C and 380 °C for 25 MPa pressure.

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PLASMA UNIT FOR SYNTHESIS OF OXIDE COMPOUNDS FOR NUCLEAR FUEL

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There are many methods for obtaining powder materials, which can be divided into 4 large groups: chemical reactions in solution and gas phase; condensation in the gas phase; chemical reactions in solids; nucleation from solutions or melts (sol-gel). Each of them has its own technological features, and accordingly advantages or disadvantages.

When it comes to obtaining compounds for the fabrication of nuclear fuel, such factors as product purity, homogeneous phase distribution, and powder monodispersity come to the fore. All these advantages are provided with the use of plasmachemical technology [1]. It has been shown that oxide compounds obtained by this method belong to the nanosized class, which contributes to the homogenization of products, an increase in their density, which leads to a decrease in the compacting pressure and temperature of sintering of fuel pellets [2].

Figure 1 shows a photograph (a) and a scheme (b) of a plasma module based on a high-frequency torch (HFT) plasmatron.

Air flow *1* is supplied to the reactor through an impeller with a variable swirl angle. Air plasma stream *2* is initiated along the axis of the reactor. Disperser *3* converts initial solutions into drops. Exhaust gases and products *4* are removed from the reactor.