SiC/SiC composites are expected to be the structural material of helium gas-cooled fusion reactor system. The operation temperature of the gas-cooled fusion reactor will be over 1000°C. The thermal stress resistance value is used well to investigate the total performance at elevated temperature of a material for the fusion applications, and the main objective of this paper is to study of correlation between the value and microstructure which is affected by thermal and irradiation environments. The thermal stress resistance value is the results of multiply of yield stress and thermal conductivity of a material, the final character of the material depends on the balance of both values. This results in not-distinguishable the both effects for the thermal stress resistance. This research tried to distinguish both parameters and investigate the weight of them under fusion environments.

Two candidate composites were used, one was consolidated Tyranno-SA fibers which simulated SA-Tyrannohex, and another was high thermal resistant type SiC/SiC composites which were produced by the liquid phase sintering with SiC nano-powder as same as the newly SiC material, NITE SiC/SiC composites.

The thermal stress resistance decrease with increasing of temperature, and it drops significantly over 1000°C in the case of SA-Tyrannohex. The thermal stress resistance of high thermal resist type SiC/SiC composites gradually decreases over 1000°C. At first, the correlation of microstructural evolution and the change of thermal stress resistance was investigated.

Ion-irradiation experiments were performed from room-temperature to 1600°C to investigate the microstructural evolution by thermal and irradiation complex effects. Ion-irradiation experiments were performed at DuET facility, Kyoto University. TEM and the laser flash thermal conductivity measurements were used for the investigation of materials to develop the prediction technique of thermal stress resistance under the fusion environments.