

## 論文の内容の要旨

論文題目     A study on the heat pipe for cooling fuel debris in  
                  Fukushima Dai-ichi NPP decommissioning  
                  (福島第一原子力発電所廃炉における燃料デブリ  
                  冷却用ヒートパイプに関する研究)

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In the Fukushima accident in 2011, fuel assemblies and core components were damaged, and the fuel debris melted out of Reactor Pressure Vessel (RPV) and fell down at the bottom of the containment vessel. In order to cool down the fuel debris, the water has been injected, which generates a large amount of contaminated water. Suzuki et al. proposed to use geopolymer to cool down and retrieve fuel debris without making contaminated water during Fukushima decommissioning. Geopolymer can provide efficient and practical on-site treatment of radioactive waste streams. It can be used for on-site solidification of highly active materials so that fuel debris can be removed properly. However, geopolymer has a very low heat conductivity, which can be seen as an insulator. Therefore, during the process of applying geopolymer, residual heat must be transferred from fuel debris to outside somehow. The objectives of this study is to develop heat pipes which can be applied in reactors, transferring the heat from fuel debris to the air. The research goal is to study the irradiation effect on heat pipe performance and to obtain the suitable heat pipe in the irradiation environment. Material properties such as capillary pressure, permeability, and contact angle were studied. The inner structure of the heat pipe were designed. Different heat pipes with different configuration were designed. The heat pipe performance test system was newly designed. The irradiation test on heat pipes were performed and corresponding heat pipe power were calculated. The reason for heat pipe performance degradation was studied.