MARINE: Irradiation of Sphere-Pac Fuel and Pellets of UO2-x Containing 13% Americium

Abstract:
Americium is a strong contributor to the long term radiotoxicity of high activity nuclear waste. Transmutation by irradiation in nuclear reactors of long-lived nuclides like 241Am is therefore an option for the reduction of radiotoxicity of waste packages to be stored in a repository. The MARINE irradiation experiment is the latest of a series of European experiments on americium transmutation (e.g. EFTTRA-T4, EFTTRA-T4bis, HELIOS, MARIOS, SPHERE) performed in the HFR (High Flux Reactor). The MARINE experiment is carried out in the framework of the 4-year project PELGRIMM of the EURATOM 7th Framework Programme (FP7). During the past years of experimental works in the field of transmutation and tests of innovative nuclear fuels, the release or trapping of helium as well as helium induced fuel swelling have been shown to be the key issues for the design of Am-bearing targets devoted to heterogeneous recycling. MARINE will test the Minor Actinides Bearing Blanket (MABB) fuel concept, comparing sphere-pac fuel performance to that of pellet fuel under similar circumstances, similar to its predecessor SPHERE. The main objective of the MARINE experiment is to study the in-pile behaviour of natural UO2 fuel containing 13 % of americium (compared to MOX fuel containing 3% Am in SPHERE). In particular the role of microstructure and temperature on He and fission gas release as well as on fuel swelling will be addressed. The MARINE experiment will start in 2015 in the HFR in Petten (The Netherlands) and is expected to be terminated in 2016. The experiment has been designed to last up to 15 reactor cycles (corresponding to 15 months) but may reach its target earlier. This paper discusses the rationale and objective of the MARINE experiment and provides a general description of its design which is based on the one previously developed for the SPHERE irradiation now on going in the HFR in the framework of the R&D studies related to MA homogeneous recycling in SFR.

URI:

Authors:
D'AGATA Elio
HANIA Ralph
SOMERS Joseph
FREIS Daniel
BEJAOUI Syriac
CHARPIN-JACOBS Florence
BAAS Peter
OKEL R.A.F.