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Analysis of experimental data on fission gas release and swelling in mononitride fuel irradiated in BR-10 reactor

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Uranium mononitride fuel was used in the fourth and fifth BR-10 reactor core loadings. The total number of irradiated fuel pins was 1250 (660 and 590 fuel pins in fuel loadings IV and V respectively). Most fuel pins were irradiated up to design burnup (8%) without cladding failure.

In addition to standard FAs, some experimental FAs were irradiated in BR-10 reactor. The post irradiation examination (PIE) of 8 standard and 3 experimental fuel assemblies (FA) was done in the IPPE hot lab.

The paper presents the results of study of fission gas release and nitride fuel swelling in standard and experimental fuel pins irradiated in BR-10 reactor. These two phenomena have a significant impact on cladding stress level and therefore on the fuel life time.

Substantial fission gas release from BR-10 nitride fuel starts at a burnup of more than 3at%. Irradiation temperature increase and fuel density decrease both lead to increase of gas release rate. $N_{14}(n,\alpha)B_{11}$ nuclear reaction in nitride fuel causes formation of quite big amounts of helium. This fact should be taken into account in computer codes used for nitride irradiation behavior modeling. The paper presents the measured nitride swelling rate values in the temperature range from 760 to 1115 C. Increase of fuel temperature leads to increase of fuel swelling rate.

Country/Int. Organization

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