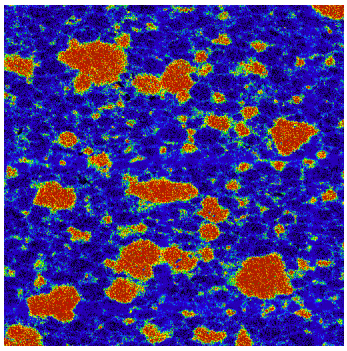
Method for producing nuclear fuel pellets of the MOX type

Description

Industrial fabrication of mixed oxide nuclear fuels (MOX) for Light Water Reactor (LWR) applications relies on processes involving powder milling, mixing, pellet pressing and thermal treatment. The present invention relates to one of these processes, called MIMAS (MIcronized MASter blend), consisting in milling U-Pu oxide (master blend) and then diluting it with UO2 to give a MOX with the desired Pu content (final blend), followed by compaction and sintering to render dense fuel pellets. Despite uniform macroscopic appearance, the final product of this process is chemically heterogeneous, which leads to two major disadvantages:
- The power produced in the fuel is localised in the Pu-rich particles, inducing greater local damage of the material and higher fission gas release;
- Following irradiation, the dissolution of the spent fuel in nitric acid for reprocessing is retarded by less soluble Pu-rich regions.
In the present invention, a new UO2 powder which is very diffusion active was developed. When mixed with a MIMAS primary blend, cation-interdiffusion occurs between the (U,Pu)O2 in the Pu rich particles and the UO2 powder so that a homogeneous fuel is rapidly (or easily) obtained. The grain size of the (U,Pu)O2 is also increased without the addition of external agents. The advanced UO2 precursor can be fabricated in conventional Uranium facilities (no alpha contamination) and existing MOX fabrication facilites utilising MIMAS process can be used directly for the new process, without extra cost.



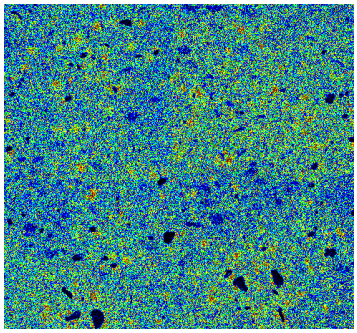
MIMAS fuel

Areas of application

- Nuclear fuel for Light Water Reactor application
- MOX production

Innovative aspects and main advantages

- Homogeneous distribution of Pu throughout the material
- Better in-pile performance in the reactor
- Higher burn-ups of the fuel



MIMAS fuel with 500ppm Bentonite

Stages of development

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Patent pending CA, JP, NO

Scientific Contact

Dr. Didier Haas
European Commission
Joint research Centre, ITU
D-76125 Karlsruhe, Germany
Tel: (+49) 7247951 367
Email address: didier.haas@ec.europa.eu

Licensing Contact

Intellectual Property and Scientific Collaboration Unit
DG JRC - European Commission
B-1049 Brussels, Belgium
Email: JRC-TechTransfer@ec.europa.eu

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