

Re: I'm hearing bad things about breeder reactors

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dezakin@usa.net (Dez Akin) wrote in message
news:<dd43b4da.0406110034.2d3f2a74@posting.google.com>...
> "Eunometric" <eunometric@yahoo.com.au> wrote in message
news:<ChZxc.1133\$sj4.1070@news-server.bigpond.net.au>...
> > "brianb" <bri1600bv@hotmail.com> wrote in message
> > news:68a6629.0406090711.701863fd@posting.google.com...
> > > eunometric@yahoo.com.au (Eunometric) wrote in message
> > news:<e935396a.0406081726.2b818661@posting.google.com>...
> > > > bri1600bv@hotmail.com (brianb) wrote in message
> > news:<68a6629.0406080759.931460d@posting.google.com>...
> > > > They're saying that they could never work out the kinks and that
> > they
> > > > are incredibly expensive etc.
> > > >
> > > > Are breeder reactors in general more expensive than non
> > breeders, if
> > > > they CAN work out the kinks?
> > > >
> > > > Does anyone know what the current status of research and such
> > is?
> > > >
> > > > Is it only breeder reactors that can burn plutonium? Or is the
> > idea
> > > > that by turning U238 into plutonium in a breeder that this
> > plutonium
> > > > can be burned elsewhere? I guess I'm confused about the
> > difference
> > > > between "breeder reactor" and "reprocessing". Anyone know?
> > Thanks in
> > > > advance.
>
> Breeder reactors suck now because uranium is dirt cheap, we have
> working designs for light water reactors that are competitive, and
> designing new reactors carries significant capital risk. The
> opportunity cost is too high given the price of uranium.
>
> > > > All of the breeder programmes were cut short of their full
> > development

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> > > > *and test cycle as instigated. The IFR for instance was cut down*
> *by*
> > > > *Jimmy Carter of political reasons not technical or economic ones.*
>
> *Thats not to say technical or economic reasons didnt exist. If they*
> *did, the market would be running breeders.*
>
> > *The*
> > > > *Japanese even offered to continue funding the research. The IFR*
> *was*
> > > > *very proliferation resistant because the pyro-processing can't*
> *produce*
> > > > *pure plutonium and never left the reactor building however the fear*
> *was*
> > > > *that such reactors would ultimately spread the ability of other*
> > > > *countries to produce bombs.*
> > > >
> > > > *Yes there concerns relating to corrosion resistance of materials*
> *but*
> > > > *saying that there are problems that need to be solved is not the*
> *same*
> > > > *as saying that those problems are difficult to solve. For*
> *instance*
> > > > *you can't test the corrosion resistance of various alloys and*
> > > > *materials unless you actually have a program to test them by*
> *exposure*
> > > > *to real conditions.*
> > > >
> > > > *The IFR (integral Fuel Reactor) was fueled with a mixture of*
> > *enriched*
>
> *IFR is integral fast reactor. Its a fast neutron reactor and generally*
> *fast neutron reactors are an excuse to make Pu239. Whats integral*
> *about it is that the fuel is reprocessed on site, not in the reactor.*
>
> > > > *uranium. Over its life the U235 would be fissioned for energy*
> *while*
> > > > *the U238 would convert into Plutonium at a rate faster than U235*
> *was*
> > > > *used up. The fuel would occasionally be partially removed and*
> > > > *'pyro-processed' in the reactor building itself (eliminating a*
> > > > *security issue) and returned to the reactor. As a result the IFR*
> *only*
> > > > *needed one fueling in its entire life. During pyroprocessing the*
> > > > *'actinides' were removed and returned to the reactor in a separate*
> > > > *part where their decay would provide energy and where high flux*
> > > > *neutrons would destroy the actinides.*
>
> *Pyroprocessing isn't about that... its just replacing the aqueous*
> *reprocessing technique with the molten salt electrorefining. You still*
> *have security concerns; its not proliferation resistant, you have to*

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> *pull the fuel out of the reactor. Every solid fuel reactor has this*
> *issue.*

Onsite processing eliminates the possibility of diversion during transport to a remote facility. Unlike the PUREX process, the IFR process cannot separate Pu from the other actinides. This melange is not very suitable for weapon making.

>
> > > *Beucase the actinieds were destroyed by 'transmutation' the IFR*
> *did*
> > > *not produce long term waste. IE the volume and activity of waste*
> *is*
> > > *drastically reduced.*

>
> *You can do the same thing with aqueous reprocessing... IFR is*
> *different in that the fuel rods are metallic instead of oxides, and*
> *molten salt electrorefining is theoretically cheaper. Of course you*
> *need at least an epithermal neutron spectrum to incinerate actinides,*
> *which LWR doesnt supply...*

>
> > > *Beucase the IFR needed such little fuel and even produced more*
> *than it*
> > > *used the japanese calculated that they could absorb all the*
> *uranium*
> > > *they needed into special polymer membranse suspended in the sea.*
> > > *While the Uranium would be expensice the price of electricity*
> *would be*

>
> *Seawater uranium is totally orthoganal to breeder reactors, except*
> *that if getting U from seawater is inexpensive enough, it makes*
> *breeding uneconomical for some time.*

>
> > > *hardly effected. They calculated that this would given mankind*
> > > *millions of years of energy.*

> > > >
> > > > *The French reactor 'super phenix' had some problems with tube*
> *welds*
> > > > *and has only been opperated small amount of time. It was*
> *restarted*
> > > > *recently for some transmutation experiments. The IFR can never*
> *have*
> > > > *that problem becuase it has the fuel in tubes suspended in to*
> *molten*
> > > > *sodium pool rather than the other way around.*

>
> *Ah, yes... the other problem with the IFR facility... sodium cooling.*
> *Just what you want, a positive void coefficient with most entirely*
> *prompt neutrons. I'm afraid if you must have a liquid metal fast*
> *reactor, the lead-bismuth way is the way to go.*

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>
>
> > *Thanks for your reply. Did the IFR ever get to a point where it
> could
> > be made for commercial use? I know they had a plant in Idaho, I
> read
> > an interview with the guy in charge. I think Clinton finally put
> the
> > nail in the coffin.*
> >
> > *I believe it got close. You need to build test plants and after that
> > pilot plants. There are a lot of practical things to learn. The
> > Molten Salt reactor also got close but it had corrosion problems. A
> > lot of the issues relate to the reactors breeding but not breeding
> > enough but overall the consensus is that these reactors are very
> > feasible.*
>
> *IFR was never 'close' to anything. It was a research testbed for a
> variety of technologies all shoved together into one package. In that
> sense it was very successful.*
>
> *The MSRE facility was far closer to being a commercial design. The
> corrosion problems faced were mostly dealt with with hastelloy and the
> tritium migration issue was also dealt with. Really it won't get close
> for a long time because waste disposal isn't much more than a
> political issue, and uranium is so damn cheap.*
>

The Russians have operated the BN-600 since the early 80's with something like 85% availability. A BN-800 is proposed but has been held up by lack of funding. The BN-350 operated from 1972 until about 10 years ago in Kazakhstan. It generated electricity and used waste heat for desalination.

> > *There are VHTGR (Very High Temperature Gas Reactors) that are
> > breeders. One of the more interesting cycles is the molten lead
> > breeder. They can be built up to any size but if kept down to below
> > 200MW they can be built as a self contained capsule that is sealed
> > at the factory. The complete unit is shipped and then runs for 20
> > year with no intervention completely on passive cooling. It is then
> > switched off for a while and shipped back to the factory for disposal.
> > the Russians have a lead bismuth one. A chap called Greenspan is
> > trying to build one in the USA. Then there are the thermal breeders
> > that don't need fast neutrons. There are neutron beam pumped
> > breeders.*
> >
> > *There is quite literally dozens of viable ways of building breeders.
> > almost too many to choose from.*
>

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> *The only one that is close to being economically competitive is a
> molten salt breeder. You need to have online reprocessing to make it
> competitive, and that means fluid fuel. The rest of them are
> interesting research testbeds, and have their niches, but the best way
> for doing breeding is the critical MSBR. Negative void coefficient,
> mostly delayed neutrons, thermal expansion of the fuel lowers the
> reactivity, inexpensive online reprocessing removes the nastiest of
> the neutron poisons, high core temperatures that yield high
> thermodynamic efficiency, and economic analysis that indicate that its
> about as competitive with coal fired plants today, more competitive
> than LWR's.*

>

> *The fast neutron reactors have inertia because they were originally
> designed with one purpose in mind: breed Pu239. MSR's (and every
> thermal breeder) aren't good at that.*

>

They were also designed to burn Pu239.

> *The only reactor technology I like better than MSR's are the
> nonexistant fissioning plasma core reactor ideas... if we could find a
> way to make sure the plasma flourides don't eat away at the reactor
> core vessel. Maybe the fusion plasma physics guys should redirect
> their efforts for a while.*