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[1] Stainless steel cladding goes under void swelling, irradiation creep and lose their mechanical stability at high temperature. As they lose their ductility and hardening increase. ✓

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and at fast reactors metal are expected to go under void swelling, He embrittlement, irradiation induced precipetations, irradiation induced creep, irradiation hardening and growth.

[2] Adding Cr to Steel increases the ~~co~~ corrosion resistance and increases the hardenability

but reduction of Cr lead to a reduction of oxidation resistance.

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- this is saying the same thing twice
- would like another example

(3) Ferritic steels swell less

① relaxation volume in ferritic steel is larger so we have larger strain which promotes the mobility of vacancies and recombination happens.

② vacancies are more mobile in ferritic steel so recombination occurs.

③ vacancies are trapped in carbide percipitates

④ Dislocation attracted vacancies in their strain field.

④ The role of oxide particles in ODS

Oxide particles are disposed in ferritic steel such as Y_2O_3 these oxides help in stabilizing ferritic steel and increase the swelling resistance and creep resistance.

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⑤ Advantages of Ni alloy

Ni alloys have good corrosion resistance

But as a disadvantage

it goes under the embrittlement because 58Ni has a neutron capture cross section which generates He.

also stress corrosion cracking is a concern as fracture stress reduces with increasing percipitates size.

- Adding Cr will increase the corrosion resistance.

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how is strength improved?

⑥ unique features of RR

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① fuel used is intermetallic fuel such as U-Al / U-Si & U-Mo

② operates at lower temperature

③ fuel has much higher uranium density to use lower enriched uranium.

④ High fission density

⑤ Higher burn up

⑥ no gap or plenum is the fuel.

(7) Amorphization

it happens due to the high fission rate + low T

and it leads to fission gas bubbles growth

due to the volume reduction that happens when UAl_x fuel transform into UAl_4.

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(8) Benefits of U-Si

it has high uranium density

the fabrication of usi using atomization makes it have less impurities and less interaction with matrix and having lower stress and lower defect.

- why U-Mo fuel?

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(9) The swelling U_3Si_2 is less than in U_3Si

because in U_3Si_2 the Si/U ratio is larger and this suppress the fission gas bubbles growth rate. - in the amorphous phase

- all relates to amorphous properties

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(b) U-Mo gamma phase is stable

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because Mo is used as a stabilizer for UMo fuel ✓
even after irradiation it's stable. ✓

- phase reversion under irradiation
- slow transformation kinetics

(ii) U-Mo fabrication

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1- fuel powder and Al powder are compacted together
2- Cover and frame of the cladding are welded.
3- hot rolling applied
4- Blistering test the x-ray for geometry
5- cold rolling
6- cut all excess material.

- this is just listing a fabrication process, this doesn't answer the question

(12) fission gas bubble exist in U-Mo fuel at high density but small in size so they don't affect the volume. ✓

7/10 but with increasing burnup the gas bubbles growth rate increases and by increasing the fission density the gas bubble size increases. ✓ which leads to swelling.

- grain refinement destroys the fission gas superlattice

(13) The Zr layer purpose is to prevent the interaction between the fuel dispersed particles and the Aluminium matrix.

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- dispersed fuel doesn't have Zr layer

(14) Al canbe used in Research reactors as they don't operate at high temperature. ✓

8/8 Al keeps it's mechanical stability at low temperature as the coolant temperature is less than 100°C ✓ also swelling is not a concern at such low temperature.