Which are the conditions under which structural materials become brittle?

The conditions under which structural materials become brittle are high strain rates or low temperatures. This phenomenon is known as embrittlement and is determined by the material's impact toughness. The threshold is called the "ductile to brittle transition temperature" (DBTT) and is shifted towards higher temperatures after fast neutron irradiation. This information can be found on page 7.

What are the life-limiting factors for fuel cladding tubes?

The life-limiting factors for fuel cladding tubes include the accumulation of fission gas pressure inside the tube, as well as radiation-induced damage and the formation of a burn-up gradient along the tube. These factors can lead to mechanical failure and compromise the integrity of the barrier. (Page 104)

Which phenomena are safety limiting during transients?

The phenomena that are safety limiting during transients in fast neutron reactors include high peak temperatures and fast neutron fluence, which can lead to cladding failure and fuel melting. This is discussed on pages 3-4 of the document "Fast neutron Generation IV reactors" by J. Wallenius & S. Bortot.

Thermal creep ≠ irradiation creep! why?

Thermal creep and irradiation creep are different phenomena because they result from different types of stress: thermal creep occurs due to a constant load and temperature, while irradiation creep is induced by fast neutron irradiation. This is explained in pages 94-95 of the document "Fast neutron Generation IV reactors" by J. Wallenius & S. Bortot.

How does fast neutron irradiation affect the swelling of austenitic steels in liquid metal cooled reactors?

Fast neutron irradiation causes swelling in austenitic steels in liquid metal cooled reactors. The addition of titanium, silicon, and phosphorus can suppress swelling but can also cause precipitation of carbides. Cold working and the use of certain alloys, such as AIM1 and 25% Ni austenites, have been shown to improve swelling tolerance. This information can be found on pages 96-97 of "Fast neutron Generation IV reactors" by J. Wallenius & S. Bortot.

What are the potential uses of alloyed austenitic steels in liquid metal cooled reactors?

Alloyed austenitic steels can be used as fuel cladding tubes, steam generator tubes, and primary vessel materials in liquid metal cooled reactors. They are known for their high ductility and strength, and can withstand radiation damage. Specific examples of their potential use include co-extrusion with Alloy 800 for corrosion protection of steam generator tubes and surface alloying with pulsed electron beam technique on SS316 for pressure vessels. (Page 104-105)