JHR Working GROUP on Material: **Potential topics of interest : grid proposal**

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	Topic	Experimental objectives	Type of material Type of sample	Irradiation conditions	Type of instrumentation	On site manipulation	irradiation device	irradiation parameters	Relevant associated expertise	Participant comments	Participant Ranking 1=low --> 4=High
1	**LWR structural material properties**										
2	Reactor pressure vessel	irradiation effet on the microstructure and mechanical properties	low alloyed steels for BWR and PWR, samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring	possibility of up and own loading radioactive samples in dedicated capsules	CALIPSO /MICA	T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstrutural analysis methods and mechanical testing		
3	Reactor pressure vessel	irradiation effet on the microstructure and mechanical properties	welding material , samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring	possibility of up and down loading radioactive samples in dedicated capsules	CALIPSO /MICA	T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstrutural analysis methods and mechanical testing		
4	Reactor pressure vessel	separate effect on late blooming effect	low alloyed steels for BWR and PWR, different contents of Cu, samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring	possibility of up and down loading radioactive samples in dedicated capsules	CALIPSO /MICA	T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstrutural analysis methods and mechanical testing		
	Reactor pressure vessel	irradiation effect on the microstructure and mechanical properties, *influence of flux and spectrum*	low alloyed steels for BWR and PWR, samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring	possibility of up and down loading radioactive samples in dedicated capsules	CALIPSO/MICA	T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstructural analysis methods and mechanical testing		
	Internals	effect of simultanious irradiation and deformation on initiation (before and after initiation)	austenitic stainless steels, tensile samples	only irradiation	elongation and stress	hot specimen installation	CALIPSO/MICA		microstructural analysis methods and mechanical testing, modelling		
	Internals	effect of simultanious irradiation and environment	austenitic stainless steels, tensile samples	irradiation in LWR environment	elongation and stress	hot specimen installation	CLOE		microstructural analysis methods and mechanical testing, modelling		
	Reactor pressure vessel	irradiation effet on the microstructure and mechanical properties	RPV steel of Indian Origin, samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring	possibility of up and own loading radioactive samples in dedicated capsules	CALIPSO /MICA	T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstrutural analysis methods and mechanical testing		
1	**Cladding integrity for LWR**										
2	4.1 from fuel aimed to cladding integrity	Cladding integrity at High Burnup; special enphasis on Fuel cladding chemical interaction	Zircalloy, M5	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring		CALIPSO /MICA	T=400°C, Flux= 10e12 to 10e14n/cm2/s, spectrum: mixed, highest dose: 1.510e21n/cm2	microstrutural analysis methods and mechanical testing		
	Cladding (Gen II, III)	deformation as a function of burn-up (flux, temperature)	Zr-alloys, austenitic stainless steels	only irradiation	biaxial strain		CALIPSO/MICA		microstructural analysis methods and mechanical testing, modelling		
	Cladding (Gen II, III)	deformation as a function of burn-up (flux, temperature)	Zr-alloys, austenitic stainless steels	irradiation in LWR environment	biaxial strain				microstructural analysis methods and mechanical testing, modelling		
	Cladding/Fuel rod (Gen II, III)	oxidation behaviour, accident tolerance	Zr-alloys, austenitic stainless steels	irradiation in LWR LOCA conditions		resistance measurement	ADELINE/LORELEI		microstructural analysis methods and mechanical testing, modelling		
	Cladding for high temperature and high burn-up applications	Effect of irradiation on microstructure, and hardening, embrittlement, creep.	Selective binary, ternary and quaternary alloys in Zr-Nb-Sn-O system, tensile specimens.	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring, biaxial stress (in-situ loading)		Instrumented MICA (Melodie); Ring 1	T=350°C, Flux= minimum 3.1e14n/cm2/s (minimum e20-e21 n/cm2 fluence), E>1MeV	microstructural analysis methods and mechanical testing		
1	**Gen IV Materials**										
2	4.1 from fuel aimed to cladding integrity	Cladding integrity at High Burnup; special enphasis on Fuel cladding chemical interaction	15-15 Ti austenitic steel, ODS	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring			T=500°C, Flux= 10e12 to 10e12n/cm2/s, spectrum: mixed, highest dose: 1.510e21n/cm2	microstrutural analysis methods and mechanical testing		

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3	Reactor pressure vessel	irradiation effet on the microstructure and mechanical properties for lead reactor	T91, 316 L, 316 LN	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring			T=300°C, Flux= 10e10 to 10e13n/cm2/s, spectrum: mixed, highest dose: 1.510e20n/cm2	microstrutural analysis methods and mechanical testing		
4	Cladding (Gen IV)	deformation as a function of burn-up (flux, temperature), oxidation	ferritic-martensitic stainless steels, austenitic stainless steels	irradiation in GEN IV environment	biaxial strain				microstructural analysis methods and mechanical testing, modelling		
	behaviour of innovative materials	irradiation effect on the microstructure and mechanical properties	hot isostatic pressed austenitic stainless steel	irradiation in LWR environment	temperature, flux and dose monitoring				microstructural analysis methods and mechanical testing		
	Reactor pressure tube with novel microstructure and texture	Effect of irradiation on microstructural stability, beta phase stability and creep.	Zr-2.5Nb, samples as small as TEM samples (3mm disks), up to 1T CT samples including tensile and charpy specimens	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring, biaxial stress (in-situ loading)		Instrumented MICA (Melodie); Ring 1	T=300°C, Flux= minimum 3.1e14n/cm2/s (minimum e21 n/cm2 fluence), E>1MeV	microstructural analysis methods and mechanical testing		
	Nb-based alloys for high temperature reactor application	irradiation effect on the microstructure and mechanical properties	Nb-1Zr-0.1C	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring		MICA; Ring 1	T=1000°C, Flux= minimum 3.1e14n/cm2/s, E>1MeV (depending upon availibility of high temperature facility)	microstructural analysis methods and mechanical testing		
	AHWR Fuel Clad tube	irradiation effect on the microstructure and mechanical properties	Optimised Zircaloy-2	BWR environment	temperature, flux and dose monitoring		MICA; Ring 1	T=300°C, Flux= minimum 3.1e14n/cm2/s (minimum e21 n/cm2 fluence), E>1MeV	microstructural analysis methods and mechanical testing		
	TRISO Particles in graphite compacts	irradiation effect on the microstructure and mechanical properties	PyC& SiC coated on surrogate Zirconia kernels in graphite compacts	HTR environment	temperature, flux and dose monitoring		MICA; Ring 1	T=1000-1400°C, Flux= minimum 3.1e14n/cm2/s (minimum e21 n/cm2 fluence), E>1MeV(depending upon availibility of high temperature facility)	microstructural analysis methods and mechanical property evaluation		
	Yttria stablised Zirconia	Irradiation effect on structural stability and microstrucutre, mechanical properties	YSZ	Irradiation under SCWR condition	temperature, flux and dose monitoring		MICA; Ring 1	T=600°C, Flux= minimum 3.1e14n/cm2/s, E>1MeV (depending upon availibility of high temperature facility)	microstructural analysis methods and mechanical testing		
	High temperature irradiation of pure metals	irradiation effect on the microstructure and mechanical properties	Pure Nb, Zr and Ni	Controlled atm, T° and thermal conductivity between the sample in each capsule	temperature, flux and dose monitoring		MICA; Ring 1	T=500°C for Nb and Ni, and 300°C for Zr; Flux= minimum 3.1e14n/cm2/s, E>1MeV (depending upon availibility of high temperature facility)	microstructural analysis methods and mechanical testing		
	BWR/AHWR oxidation, Oxidation-SCC relation	Effect of irradiation on oxide film formation and growth, Oxidation kinetics, Hydrogen pick up and comparison with similar set of experiments in a out of pile loop; irradiation effects on RIS	SS 304L/LN, Zircaloy-2, Optimized Zircaloy-2, Zr-2.5Nb PT for AHWR/PHWR; small specimen	BWR environment (for SS304LN and 304L, Zr-2 and Zr-2.5Nb)	Temperature, flux, water chemistry, stress	Keeping the crack tip in acitve condition; by user		T= 320 C, Flux E>1MeV Fluence (range) ~ 10+20 n/cm2	Oxide developed on stressed crack tip vs oxide developed on non stressed surface in BWR environment: detailed oxide characterization and depletion of elements below the oxide/region ahead of crack tip		
	PWR oxidation, Oxidation-SCC relation	Effect of irradiation on oxide film formation and growth, Oxidation kinetics, Hydrogen pick up and comparison with similar set of experiments in a out of pile loop; irradiation effects on RIS	SS 304L/LN, Zircaloy-4, Optimized Zircaloy-4; small specimen	PWR environment (for SS304LN and 304L, Zr-4, as received and in pre-oxidized condition)	Temperature, flux, water chemistry, stress	Keeping the crack tip in acitve condition; by user		T= 350 C, Flux E>1MeV Fluence (range) ~ 10+20 n/cm2	Oxide developed on stressed crack tip vs oxide developed on non stressed surface in BWR environment: detailed oxide characterization and depletion of elements below the oxide/region ahead of crack tip		