Liquid metal technology: materials issues in fusion, fission and solar energy

Context and objectives of the workshop

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www.eera-set.eu

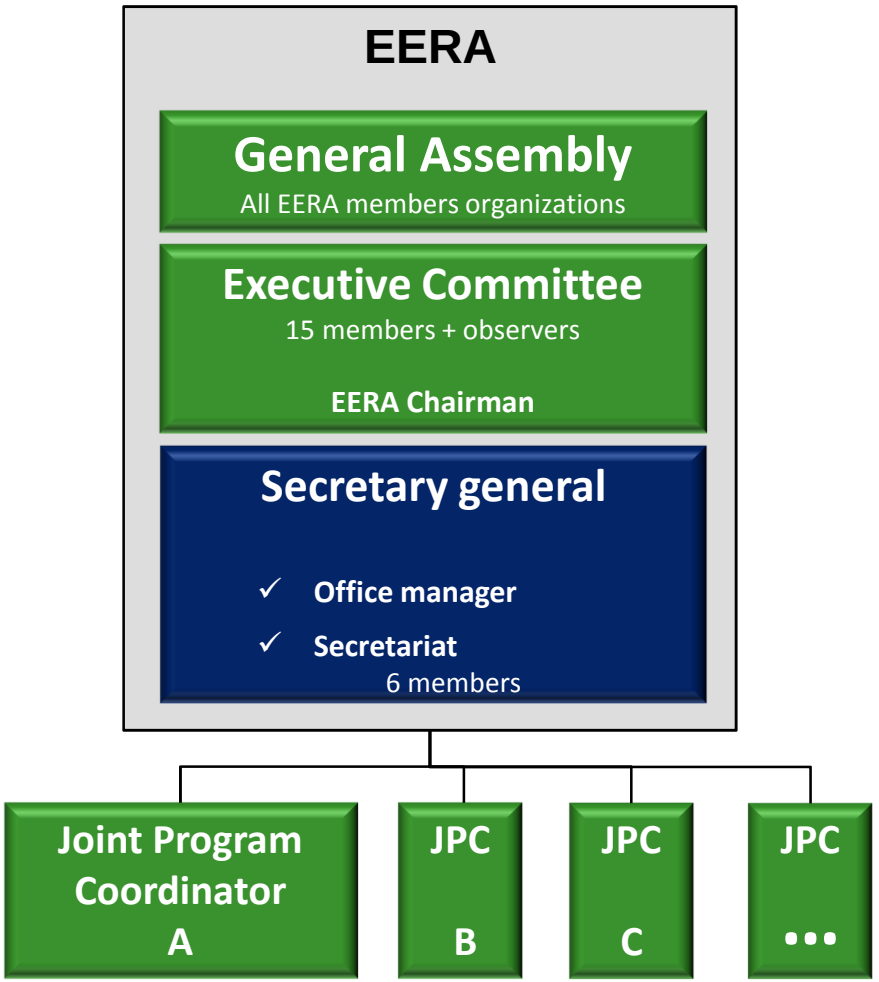
EERA is an official part of the EU SET-Plan.

http://setis.ec.europa.eu/

The European Energy Research Alliance coordinates energy research for a low carbon Europe

- **Alliance of European public research centres and universities** *(international non-profit association according to Belgian law)*
- **Cornerstone of the European Strategic Energy Technology Plan (SET-Plan)**
- **Brings together >250 research organisations**
- **Works through 16 joint research programmes where research organisations share priorities & run research projects**

The JP on Nuclear Materials is one out of 16 JPs constituting the backbone of EERA

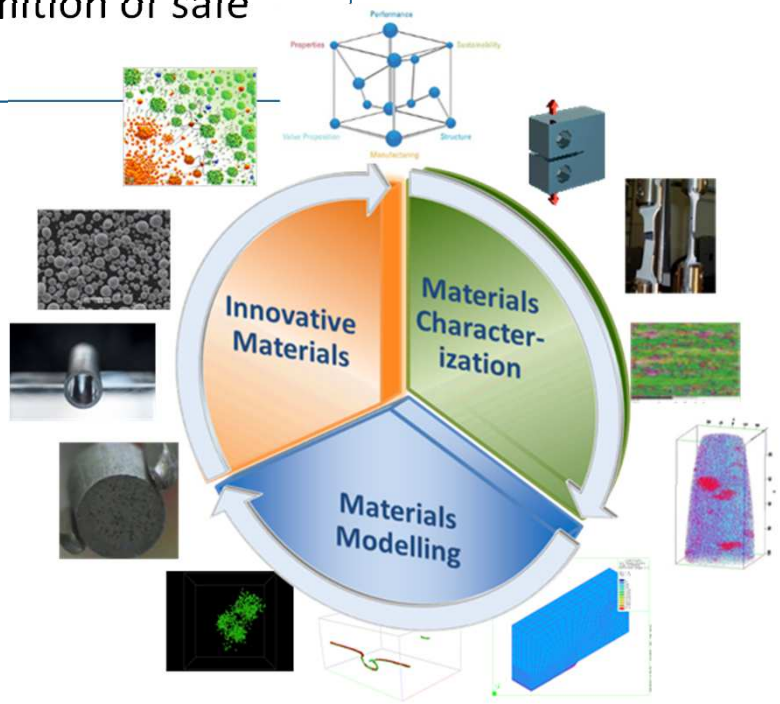


EERA has the unique specificity of keeping under the same umbrella all low carbon energy technologies: it has the vocation of naturally fostering cross-cutting research activities

Objectives of the EERA JPNM

Pursue **better knowledge of materials behaviour** in operation (radiation & temperature effects, compatibility issues) to select most suited materials & support definition of safe design rules for advanced nuclear systems

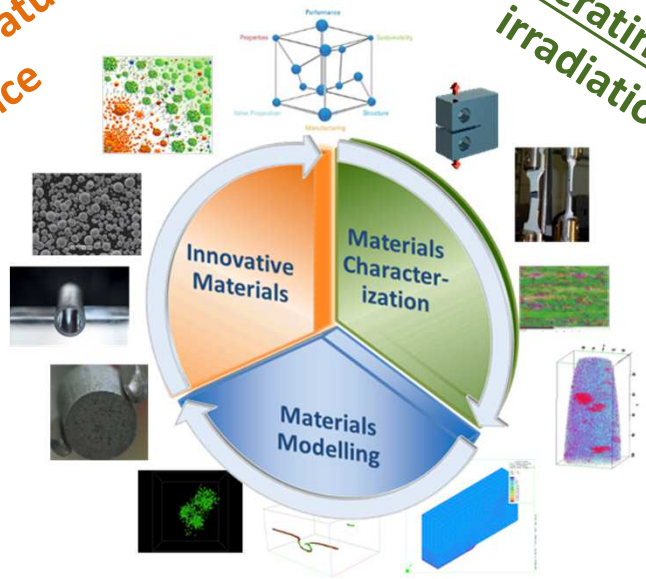
JPNM → improve **safety & sustainability** of Nuclear Energy, focusing on **materials aspects**



Develop **innovative materials for industrial use** with superior capabilities in terms of resistance to irradiation, high temperature and aggressive environments

Three JPNM grand challenges

Development of new materials of nuclear-relevance, with superior thermo-mechanical properties: radiation-, temperature- and corrosion-resistance

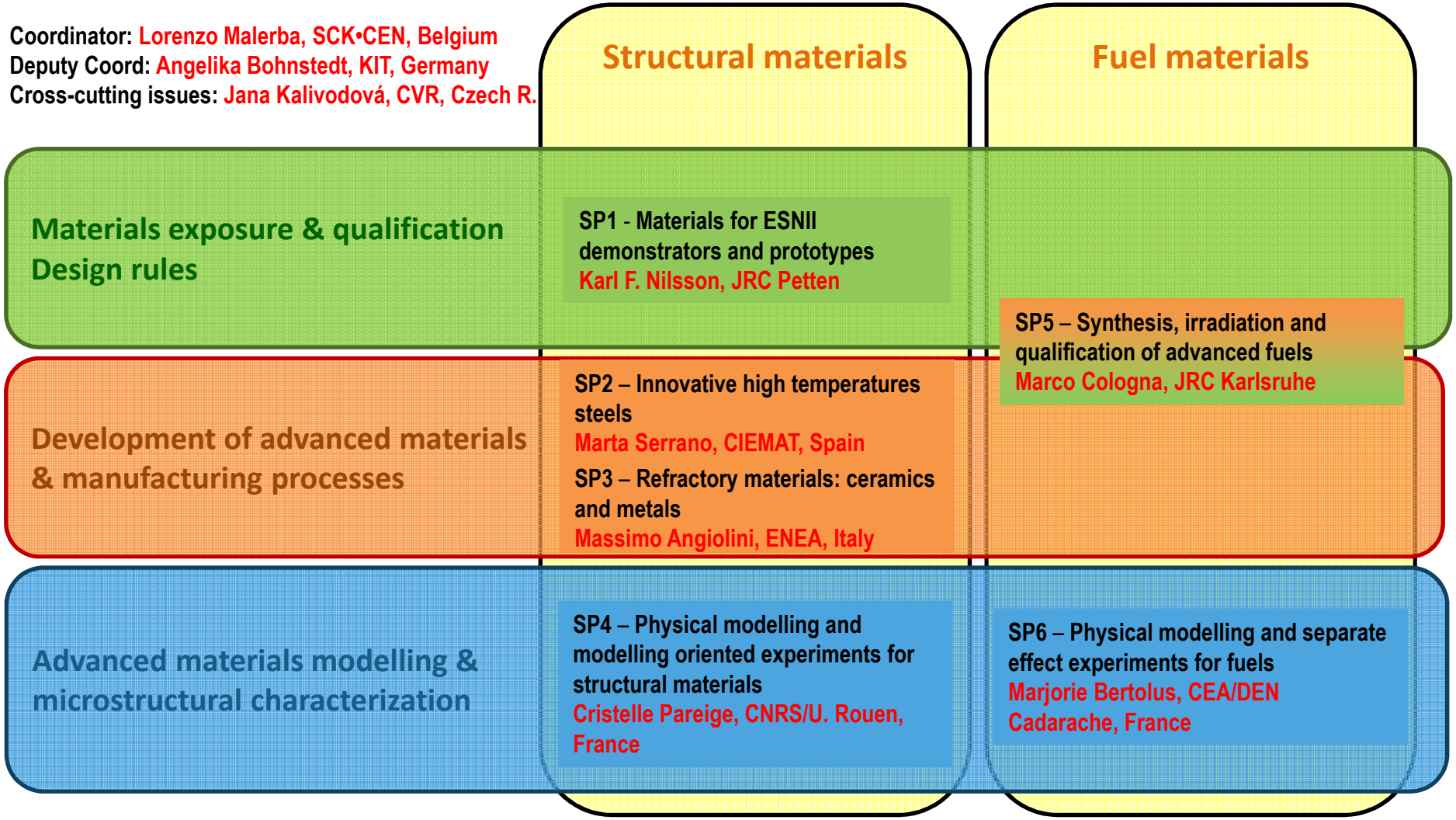


Elaboration of design rules and procedures for assessment and testing of the materials envisaged, at the expected operating conditions (high T, prolonged irradiation, aggressive environment).

Development of physical models coupled to advanced microstructural characterization to achieve high-level understanding and predictive capability

Organisation in subprogrammes & management board

Coordinator: Lorenzo Malerba, SCK•CEN, Belgium
Deputy Coord: Angelika Bohnstedt, KIT, Germany
Cross-cutting issues: Jana Kalivodová, CVR, Czech R.



JPNM: 52 Participants, 18 countries

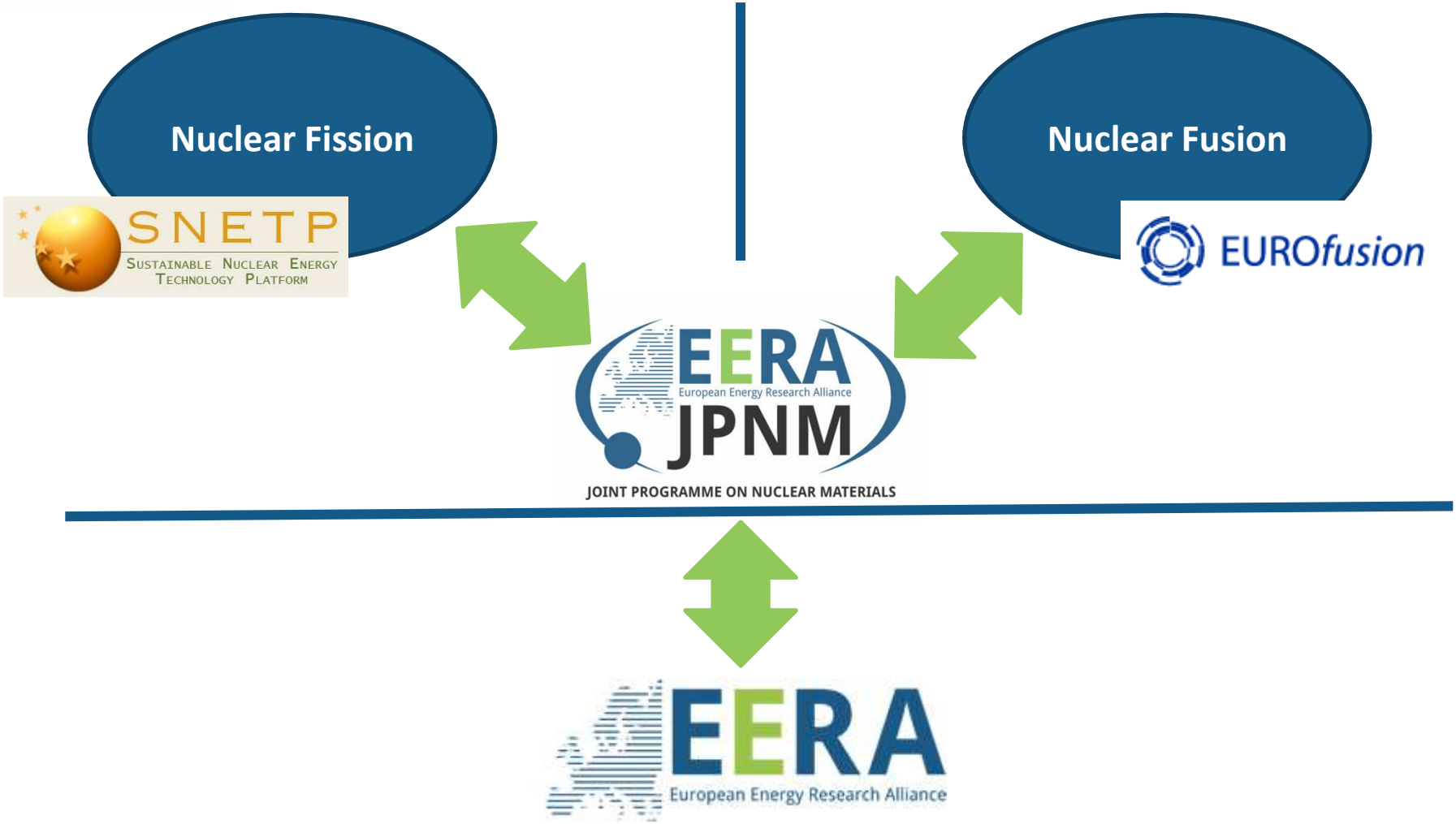
Nr.	Name	Country	Role / Responsibility
1	**CEA**	France	Full participant / **SP6 coordinator**
1.1	EDF	France	Associate / **Industry**
1.2	UTBM	France	Associate
2	U. Chalmers	Sweden	Full participant
3	**CIEMAT**	**Spain**	Full participant / **SP2 coordinator**
3.1	CEIT-IK4	Spain	Associate
3.2	CENIM (CSIC)	Spain	Associate
3.3	ICAMCyL	Spain	Associate
3.4	IMDEA Materials	Spain	Associate
3.5	U. Alicante	Spain	Associate
3.6	U. Cantabria	Spain	Associate
3.7	U. Oviedo	Spain	Associate
3.5	UPCatalunya	Spain	Associate
4	CNR	Italy	Full participant
5	**CNRS**	**France**	Full participant / **SP4 coordinator**
6	**CVR**	**Czech Republic**	Full participant / **X-cutting issues**
6.1	MTA EK	Hungary	Associate
6.2	STUBA	Slovakia	Associate
7	**ENEA**	**Italy**	Full participant / **SP3 coordinator**
7.1	CSM	Italy	Associate / **Industry**
7.2	IIC-SAS	Slovakia	Associate
7.3	IIT	Italy	Associate
7.4	POLIMI	Italy	Associate
7.5	POLITO	Italy	Associate
8	HZDR	Germany	Full participant
8.1	TU Dresden	Germany	Associate
9	***JRC* (Petten/Karlsruhe)****	***EU***	Full participant / **SP1/SP5 coordinator**
9.1	Raten	Romania	Associate
10	**KIT**	**Germany**	Full participant / **Dep. JP Coordinator**
10.1	DLR	Germany	Associate
10.2	MPA	Germany	Associate
10.3	NIMP	Romania	Associate
11	KTH	Sweden	Full participant

Nr.	Name	Country	Role /
12	NCBJ	Poland	Full participant
12.1	AGH	Poland	Associate
13	NRG (ECN)	The Netherlands	Full participant
13.1	TU Delft	The Netherlands	Associate
14	PSI	Switzerland	Full participant
14.1	ETH Zürich	Switzerland	Associate
15	**SCK·CEN**	Belgium	Full participant / **JP Coordinator**
15.1	Inst. Phys. Zagreb	Croatia	Associate
15.2	BERA/KULeuven	Belgium	Associate
15.3	OCAS	Belgium	Associate / **Industry**
16	UKERC	UK	Full participant
16.1	METU	Turkey	Associate
16.2	NNL	UK	Associate
16.3	CCFE (UKAEA)	UK	Associate
17	VTT	Finland	Full participant
17.1	Aalto U.	Finland	Associate
17.2	IFE	Norway	Associate
17.3	U. Helsinki	Finland	Associate

17 full members

35 associates

The EERA JPNM: a catalyser for research on materials under extreme conditions



Concentrated Solar Power, Geothermal, Fuel cells & Hydrogen, Bioenergy, ...

Cross-cutting actions of the JPNM

- High temperature materials initiative within EERA
  - JP AMPEA, CSP, Geothermal, FCH, Bioenergy, have in common the need to develop materials for high temperature applications
- MoU with SNETP → identification of commonalities with and between the three pillars: NUGENIA, ESNII, NC2I
- Dialogue with EUROfusion → M4F project (modelling), identification of other topics that could be the subject of cross-cutting fusion/fission project
  - Compatibility of components with (heavy) liquid metals is one of the subjects, chosen for this workshop
  - This topic is also common to CSP

Objective of this workshop

- **Provide an overview of the current knowledge concerning compatibility issues between materials and heavy liquid metals in fusion, fission and solar thermal energy technologies**
- **Cover all aspects, from fundamental mechanisms to protection and mitigation strategies, including whenever possible their industrial application**
- **Identify the terms for a possible cross-cutting joint research programme of benefit for different nuclear and also non-nuclear energy technologies**
- **Advocate for a suitable European framework and instrument to support such a research programme/project**

Thank you for your attention

The GEMMA, INSPYRE and M4F projects receive partial funding from the Euratom research and training programme 2014-2018