Mandate

WPFC Expert Group on Innovative Structural Materials (EGISM)

Members: All NEA member countries

Full Participant: European Commission

Observer(s): International Atomic Energy Agency (IAEA)

Date of creation: 30 April 2008

Start of the current mandate: 6 February 2019

End of mandate: 5 February 2021

Mandate (Document reference):

- Summary Record of the 21st meeting of the Nuclear Science Committee held on 9-11 June 2010 [NEA/SEN/NSC(2010)3]
- Summary Record of the 27th meeting of the Nuclear Science Committee held on 22-24 June 2016 [NEA/SEN/NSC(2016)2]

Mandate

Objectives and scope

Under the guidance of the Nuclear Science Committee (NSC) and under the mandate of the Working Party on Scientific Issues of the Fuel Cycle (WPFC), the objective of the Expert Group on Innovative Structural Materials (EGISM) is to conduct joint and comparative studies to support the development, selection and characterisation of innovative structural materials that can be implemented in advanced nuclear fuel cycles, under extreme conditions such as high temperature, high dose rate and corrosive chemical environment and long service lifetime.
Innovative structural materials may comprise, but are not limited to:

- advanced materials in terms of chemical composition and microstructure, developed to have unique properties. As an example, such developments may be achieved through integrated computational materials engineering;
- materials or material structures elaborated by novel pathways (i.e. fabrication routes such as additive manufacturing and/or joining processes) applied to existing or new structural materials;
- advanced materials in terms of design and architecture (e.g. functionally graded materials), including coated systems. Example systems could be thin films or coatings deposited by processes such as physical vapour deposition (PVD), high-power impulse magnetron sputtering (HiPIMS), laser processes and cold spray.

The objectives of the expert group are to:

- provide a state-of-the-art assessment of specific areas to be considered as priority areas of research;
- assess current status and future needs for qualification of structural materials;
- identify the areas where experimental protocols and standards are needed and where the share of available experimental installations could be possible;
- identify existing databases and common activities; and
- organise the next series of workshops on structural materials for innovative nuclear systems (SMINS).

Activities

Consistent with the above objectives, the activities of the expert group will include:

1. State-of-the-art assessment of specific areas to be considered as priority areas of research
   - Identification of system requirements for advanced reactors (conditions of use: temperature, irradiation, environment and lifetime)
   - List of innovative candidate materials to meet system requirements
   - Identification of available data on the selected innovative materials (list of properties)
   - Identification of existing modelling and simulations data
   - Identification of readiness level of each of the materials selected
   - Identification of novel material pathways (from fabrication process through to qualification) that could significantly improve material performance in advanced nuclear systems

2. Experimental protocols and standards and share of available experimental installations
   - Identification of areas where experimental protocols and standards are needed
   - Identification of challenge issues, in modelling, characterisation and experimentation, as well as round robin studies to verify consistency of results across international test programmes
   - Identification of existing and required experimental facilities, as well as the potential for collaborative research using existing experimental installations

3. Common experimental database
   - Identification of existing databases and their ownership and accessibility
   - Share common activities on structural materials (benchmark)
   - Provide recommendations on properties and behaviour laws for materials

Relationships with other bodies

The expert group will liaise closely with other NSC subsidiary bodies, especially the Expert Group on Liquid Metal Technology (EGLM), the Expert Group on Fuel Recycling Chemistry (EGFRC), the Expert Group on Accident-tolerant Fuels for Light-water reactors (EGATFL) and those operating under
the guidance of the Working Party of Multi-Scale Modelling for Fuels and Structural Materials for Nuclear Systems (WPMM), in order to ensure the complementarity of their respective programmes of work and to provide advice and support, where required, and undertake common activities, where appropriate. The expert group will collaborate with other international organisations such as the International Atomic Energy Agency (IAEA), European Commission (EC) and the Generation IV International Forum (GIF).

**Deliverables**

The deliverables of the EGISM will be the following:

- New status report on structural materials
- Summary of activities on new materials and fabrication processes
- Maintain report on “Users facilities” for advanced materials testing
- Workshop on Structural Materials for Innovative Nuclear Systems (SMINS)