Commonalities between materials development in fission and fusion technologies.

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Synergies for fission and fusion reactors material’s development could be realized in several areas. Despite the differences, the In-Vessel components in a fusion reactor face similar technological issues as core components of advanced Gen IV nuclear reactors, operating with similar coolants, temperature windows and neutron wall load parameters. The quest for higher efficiencies and extended lifetimes leads to a common interest in developing structural materials capable of prolonged operation at high temperature and fast neutron irradiation, whose application must be supported by extended design rules for both type of nuclear systems. Many of the structural materials considered for future GEN-IV and fusion power plants are similar, including ferritic/martensitic steels, oxide dispersion strengthened alloys and refractory alloys/ceramic composites. There are also many commonalities in the chemical compatibility issues with non-aqueous coolants like Pb-based alloys (Pb-Bi, Pb-Li), alkali metals (Na, Li) and inert gases (He). Those call for the development of appropriate corrosion barriers and/or optimization of the coolant chemistry. Finally, the underlying physical phenomena responsible for the degradation of material properties under irradiation are the same. Modeling of radiation effects calls upon the same theories, mathematical models and computational tools in fission as in fusion and could speed up the development of high-performance materials.