

Editorial

Special Issue on Wastewater Treatment Technologies

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Nuclear fusion is one of the most promising technologies to be adopted in the next future for the production of electricity. Indeed, since this kind of reactors adopts hydrogen isotopes as fuel, nuclear fusion power plants will not emit any green-house gases and will not suffer of fossil fuel provisions. Moreover, their operation will lead to a reduced amount of nuclear waste, mainly due to the absence of long-lived isotopes.

These are some of the reasons that push the world community to make a big effort towards the achievement of a feasible design for a nuclear fusion reactor. In order to achieve a mature design of a nuclear fusion machine, different aspects and requirements have to be considered and fulfilled, respectively, at the same time. The goal of this Special Issue was to give an overview on the different activities that are currently on-going in the design of nuclear fusion reactor from the structural and thermo-mechanical standpoint.

A total of five papers from different fusion reactor areas, such as breeding blanket, magnet and diagnostic, have been collected and are presented in this Special Issue. The paper published by Reteesh et al. [1] reports on an interesting procedure for the design of a challenging DEMO Helium Cooled Pebble Bed (HCPB) breeding blanket local region as the top cap adopting non-linear analyses aimed at the assessment of inelastic criteria foreseen by the RCC-MRx design code. Chelihi et al. [2] focussed their attention on the Thomson diagnostic structural behaviour during normal operation of WEST tokamak. Analyses highlighted that the system is able to withstand the expected loads, even though some areas of improvement were spotted. Catanzaro et al. [3] carried out a detailed optimisation of the cooling structures (both first wall channels and breeding zone tubes) of the Central Outboard Blanket (COB) segment of the DEMO Water Cooled Lead Lithium (WCLL) breeding blanket. Moreover, they proposed an innovative way aimed at the extrapolation of the thermal field calculated on a local region of the WCLL breeding blanket to the overall COB segment; with the final goal of assessing its thermo-mechanical behaviour under different loading scenarios. Bongiovì et al. [4] performed a detailed analysis of the top cap of the DEMO WCLL breeding blanket. In a first phase a thermal optimisation of the top cap region was performed. Then a mechanical analysis was carried out considering results obtained in the previous thermal step to verify that design code criteria were fulfilled. This process was iterated until both thermal and mechanical criteria were completely fulfilled. Finally, Giannini et al. [5] presented a detailed electromagnetic and structural analyses performed on the DEMO toroidal field coil system and its support structures. The structural model was used to obtain the displacement and stress fields at the various time points to perform the mechanical evaluation as well as the fatigue assessment.

Although submissions for this Special Issue have been closed, the research on nuclear fusion reactors continues with the aim of tackling the open issues in the field, in order to reach more mature reactor designs that could allow to produce “fusion electricity” by the end of the current century.

- [1] Reteesh, A.; Hernández, F.A.; Zhou, G. Application of Inelastic Method and Its Comparison with Elastic Method for the Assessment of In-Box LOCA Event on EU DEMO HCPB Breeding Blanket Cap Region, *Appl. Sci.* **2021**, *11*(19), 9104
- [2] Chelihi, B., Colledani, G.; Doceul, L.; Lefèvre, N.; Batal, T.; Garitta, S.; Fäisse, F.; Verger, J.; Bec, A. Analysis of the New Thomson Scattering Diagnostic System on WEST Tokamak, *Appl. Sci.* **2022**, *12*(3), 1318
- [3] Catanzaro, I.; Bongiovì, G.; Di Maio, P.A. Analysis of the Thermo-Mechanical Behaviour of the EU DEMO Water-Cooled Lithium Lead Central Outboard Blanket Segment under an Optimized Thermal Field, *Appl. Sci.* **2022**, *12*(3), 1356
- [4] Bongiovì, G.; Giambrone, S.; Catanzaro, I.; Di Maio, P.A.; Arena, P. Thermo-Mechanical Analysis and Design Update of the Top Cap Region of the DEMO Water-Cooled Lithium Lead Central Outboard Blanket Segment, *Appl. Sci.* **2022**, *12*(3), 1564
- [5] Giannini, L.; Boso, D.P.; Corato, V. A Combined Electromagnetic and Mechanical Approach for EU-DEMO Toroidal Field Coils, *Appl. Sci.* **2022**, *12*(6), 2766