ENERGETICS

Ammin/CRT/DENERG - Advanced Material Performance for Plasma Facing Components in Tokamaks

Funded By	Dipartimento DENERG Politecnico di TORINO [P.iva/CF:00518460019] FONDAZIONE CRT CASSA DI RISPARMIO DI TORINO [P.iva/CF:06655250014]
Supervisor	SUBBA FABIO - fabio.subba@polito.it
Contact	SUBBA FABIO - fabio.subba@polito.it
Context of the research activity	Nuclear Fusion will provide energy for future generations, but still needs a satisfactory exhaust technology. The current approach foresees a tungsten divertor, extrapolated from present devices. Alternative strategies are being considered to de-risk the development. The Liquid Metal (LM) divertor concept is promising, thanks to self-healing and the capacity to develop a vapor cloud in front of the target. Databases on LM divertors are still relatively limited, and the related technology is at a low TRL. This project focus on application of LM divertors on various tokamaks.
Objectives	The project aims at developing a modeling framework for LM divertors in tokamaks, with experimental validation from existing compact Tokamaks and projection of possible applications to DTT and EU-DEMO. The project will start by extending an already existing 0D model of a divertor LM with Li, by adding the capacity to model the replenishment of LM once it is extracted from the target by the intense heat flux. The model results will then be used to inform the upcoming experimental campaigns of the ST-60 machine (Tokamak Energy, UK), and later will be validated against the campaign results. This might possibly generate further model development, to exactly optimize the physics included in the simple first tool. As a second step, SOLPS-ITER simulations will be applied to the same machine, starting again from a partially developed pre-existing model, which includes both divertor plasma physics and a simplified but useful model for the heat propagation into the target. This model will again be validated on Spherical Tokamak machines, and then applied to DTT and EU-DEMO to assess the suitability of the LM divertor option for the next European tokamak reactor.
Skills and competencies for the	The successful candidate should have a good knowledge of basic plasma physics, and of problems related to Power Exhaust in tokamaks. Experience with the SOLPS-ITER code will also be a bonus, as well as some practical language of computing languages like MATLAB and PYTHON. From the soft-skill side, the successful candidate will be required to be willing to work in a

development of the activity	dynamic international environment, and to spend long periods abroad, participating to experimental campaigns and interacting with the relevant scientific community. He will also be requested to proactively identify early problems during the research project, and suggest and implement solutions.