

Contributions of the linear plasma facility Magnum-PSI to fusion research

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Nuclear fusion holds great potential as a clean, safe and large scale energy source. One of the key challenges in realizing commercially attractive fusion energy on earth is to find a solution for the exhaust of heat and particles from the fusion reactor. The performance of the wall material which interacts with the plasma determines the performance, lifetime and safety of future fusion power plants. The importance of this research area has resulted in a dedicated programme coordinated by EUROfusion. An important contribution to this topic is provided by linear plasma generators, which can address the complex physics of plasma wall interaction in a systematic way, with controlled plasma parameters, flexible target geometry and good diagnostic access. The linear plasma facility Magnum-PSI is capable of exposing materials to steady-state plasma conditions similar to those foreseen in ITER and DEMO. In addition, the machine is capable of reproducing the transient heat and particle loads as they occur during so-called Edge Localized Modes (ELM). By virtue of the superconducting magnet, extremely large fluences are possible within a reasonable time frame, enabling the first lifetime studies of fusion materials in a lab environment. Furthermore, results on high heat load testing of tungsten based divertor plasma facing materials (including hydrogen isotope retention by means of ion beam analysis) and high heat flux components based on liquid metals (including their resilience against transient heat loads) will be presented.