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Plasma-surface interactions leading to self-sustained discharges at the first wall

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Intense plasma-surface interactions are accompanied not only by simple surface erosion and by the plasma pollution, but it also can lead to the intense collective phenomena of the electrical discharge that maintains at the first wall and derives the energy from the main plasma.
As the fusion plasma typically contains a lot of energy and exhibits intense plasma splashes, e.g. in the ELM form, such a discharges can have a large intensity and duration. Furthermore, the modern first wall surface has a structure with microlayers –e.g. liquid metals (Li), or nanowires structure (W-fuzz), or layers that arises from the erosion/deposition pattern; this additionally is very favorable for the self-sustained electrical discharge burning.
We will consider the current theoretical approaches for the ignition and self-sustainment of the pulsed 'vacuum discharge'at the first wall surface under the external action.
Vacuum discharge means the generation of the plasma from the erosion of the electrode materials that being initiated by explosive electron emission pulses from the cathode surface. Such a naturally non-stationary pulses that are responsible for the large current transfer through the system looks to be similar to the bubbles during the boiling. Both helps to emit from the surface a desirable value of matter in a form of portions. The portion of the dense explosive plasma formed within tens of ns within micron scale provides a portion of the current –the electron bunch –ecton.
Arcing phenomenon at the first wall seems to be unavoidable due to the intense plasma action and surface micro relief developed. The modern approaches for the vacuum discharge physics under our consideration one allows to propose two general approaches for the arcing influence reduction; i.e. (i) the control of the surface layer geometry (in particular the W-fuzz thickness), and (ii) the control of the surface layer material properties (in particular the W-fuzz average density).
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