OPTICAL SIGNATURE OF RF ARCS IN THE ICRH FREQUENCY RANGE

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RF arc detection is a key operational and safety issue for ICRF systems. Indeed sustained RF arcs can cause substantial damage to the RF structures like the antenna. Arcs are also a major power-limiting factor on existing experiments. The development of fast, efficient and reliable arc detection systems is therefore of major importance. To avoid excessive damage the arc must be detected in the micro-second range and the power sources switched off. Load-resilient ICRF systems (3dB hybrid couplers, Conjugate-T) as well as recent experience with low-voltage arcs [1] request new arc detection techniques to be developed and tested.

One of the characteristics of the arcs is the associated emission of light, which makes the optical detection a natural candidate for arc detection. In this study RF arcs are generated on the dedicated MXP (Manipulator eXPeriment) test-stand [2] powered by the ASDEX-Upgrade ICRF generators. Metallic tips (copper or stainless steel) are mounted on a stainless steel probe head located at the open end of the coaxial resonator. A viewport provides direct view on the probe head permitting to mount equipment to determine the optical signature of the arcs.

Time-resolved intensity measurements were carried out using high-speed Si photodetectors with different bandpass filters (400±20nm, 500±20nm, 600±20nm). The rise time of the arc emission, the light intensity and the time evolution of the arc under different pressure conditions are discussed.

Spectral signature of the arcs was obtained using spectrometers in the visible and UV range. It is shown that the arc emission spectrum is independent of the gas pressure and that it is mainly dominated by the stainless steel components.

The results of the RF arc optical characterization is discussed with a view on the implementation of an optical arc detection system for an ICRF antenna on a fusion machine, both for sections viewing the plasma light as for private vacuum sections.

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