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Elevating the precision of RF plasma probe diagnostics by elimination of bare probe protective shields' influence


This work deals with probe diagnostics errors for radio-frequency (RF) plasma using Langmuir probes with bare protective shields that led to the proposal of a method of their correction. The parameters of xenon inductive plasma were measured by two differently located Langmuir probes having reference probes and bare protective shields. Accurate probe diagnostics with an advanced probe station VGPS-12 featuring precise registration of plasma electron energy distribution functions (EEDFs) and traditional plasma parameters, enabled effective quantitative evaluations of EEDF deviations from the Maxwell function. These deviations were considered as EEDF distortions that turned out to linearly depend on the length of the probe protective shield no. 1. Its EEDF distortions reached minimal level at the special point that was common for both probes where the shield length no. 1 became zero while the shield no. 2 remained rather long. In this point

measurement differences for both probes were maximal. Their comparison identified the principled relationship between measurement errors and EEDF distortions, which enabled corrections of all measured plasma parameters. These actions have composed a method of RF plasma probe diagnostics without influence of bare probe protective shields. Its physical analysis showed that the nature of thus studied measurement errors was a short-circuited double-probe phenomenon in the bare protective shields caused by longitudinal variation of plasma space potential.

Biography

V A Riaby has completed his studies at Kalinin Suvorov Military College from 1949-1956 and graduated with golden medal. In 1962, he graduated from the Engine department of flying apparatus, Moscow Aviation Institute (MAI). He received scientific degree candidate of technical sciences and scientific rank of senior researcher in 1972 and 1981 respectively from the same MAI department. His research interests and professional activities are concentrated in the fields of electrical propulsion, plasma physics/diagnostics and plasma technology. Currently, he is working as leading scientist at the research institute of applied mechanics and electrodynamics of the moscow aviation institute.

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