

UV Photon-Assist Ionization for Low-Temperature Plasma

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The new type of plasma generation is introduced for generating the low temperature plasma. The new type of plasma generation is consisted of two steps. One is the excitation process, the other is the ionization process. First, the device of excitation, like the electron beam, excites the neutral gas, and then the device of ionization, like the UV light source, ionizes the excited gas. The low temperature plasma generates in the successive processes.

The range of electron beam energy is determined by the excitation cross-section between of electron and a neutral gas. To get an excess excited gas, electron beam energy is chosen to a value to get a large excitation cross-section. In case of Ar as neutral gas, the value of excitation cross-section is large when electron beam energy is near 30eV. UV photon energy is almost same in the energy difference between ionization energy of neutral gas and exciting energy of neutral gas to assist to ionization of excited gas.

The method of electron beam is thermionic. The voltage of electron acceleration is 20V, beam current is 350 μ A. The wavelength of UV light source is in the range of 250nm and 680nm. First, parameters of plasma generated by electron beam are measured by Langmuir probe. And then, UV light source irradiates plasma, varying plasma parameters are measured. The plasma density tends to increase, but plasma temperature is still low; ~ 0.5 eV.