RF Discharge Generation of I Atoms in CH_3I and CF_3I for COIL/DOIL

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Experimental results of radiofrequency discharge generation of atomic iodine in CH_3I and CF_3I for a supersonic COIL/DOIL are presented. Measurements of atomic iodine concentration distribution in the supersonic flow field and their dependence on basic RF discharge parameters and flow mixing conditions are included and compared.

A radiofrequency discharge coupled by electrodes in coaxial arrangement is used to dissociate iodine atoms from CH_3I and CF_3I molecules diluted in He carrier gas. The discharge chamber is arranged directly inside an iodine injector (made of aluminum) to minimize the recombination of generated atomic iodine (AI) and enabling an increased assistance of UV light for a photo-dissociation enhancement of AI production. The effluent of the discharge chamber (i.e. iodine injector) is injected into the supersonic flow of primary gas (a mixture of N_2 and He) behind the nozzle throat under pressure and flow conditions typical for a 1-kW class supersonic COIL.

Measurements of AI concentration distribution along and across the supersonic flow field are done by means of absorption measurements at the wavelength of 1315 nm. An occurrence of excited iodine atoms without presence of singlet oxygen is detected by optical emission spectroscopy at the same wavelength. Dependences of atomic iodine generation on basic RF discharge parameters and flow mixing conditions are measured. Our novel method [1] proves to be a promising alternative to the chemical generation of AI and also a more efficient alternative to other electric discharge methods of AI generation for COIL and DOIL.

[1] Schmiedberger J., Jirásek V., Kodymová J., Rohlena K., "Advanced Concept of Discharge Oxygen-Iodine Laser", 38th AIAA Plasmadynamics and Lasers Conference, CD Proceedings 2007, paper AIAA 2007-4239, 1-13 (2007)

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