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GENERATION OF ATMOSPHERIC PRESSURE NON-THERMAL PLASMA BY DIFFUSIVE AND CONSTRICTED DISCHARGES IN REST AND FLOWING GASES (AIR AND NITROGEN)

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Abstract. Weekly ionized non-thermal plasma (NTP) is of great interest for many applications because of its strong non-equilibrium state wherein an average electron energy T_e exceeds markedly gas temperature T_g, i.e. electrons in the NTP are strongly overheated compared to neutral gas. Energetic electrons due to frequent collisions with the neutrals excite and dissociate effectively atoms and molecules of the plasma-forming gas that results in a creation of physically-, and bio-chemically active gaseous medium in a practically cold background gas. At present there are many kinds of plasma sources working at low and atmospheric pressure and using MW, RF, low frequency, pulsed and DC power supplies for NTP generation. The NTP at atmospheric pressure is of considerable interest for practice. A reason is that sustaining the NTP at atmospheric pressure at first allows us to avoid the use of expensive vacuum equipment and second gives opportunity to use the NTP for treatment of the exhausted gases and polluted liquids. The second opportunity cannot be realized at all with use of the NTP at low pressure.

Main subject of this talk is low current atmospheric pressure gas discharges powering with DC power supplies. Plasma forming gases are air and nitrogen which are much cheaper compared to rare gases like He or Ar. Besides, great interest to molecular nitrogen as plasma forming gas is caused first of all its unique capability to accumulate huge energy in vibration, electron (metastables) and dissociated (atomic) states providing high chemical reactivity of the activated nitrogen. All active particles mentioned above have a long lifetime, and they can be therefore transported for a long distance away from place of their generation.

Different current modes (diffusive and constricted) of these discharges are discussed. Experimental and numerical results on generation of chemically active species in the diffusive and constricted mode are presented. Some data on the usage of the atmospheric pressure NTP for gas cleanup, surface treatment and sterilization are given.