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Study of Diglyme Plasmas by Optical Emission Spectroscopy and Langmuir Probe Analysis

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Thin films polymerized from diethylene glycol dimethyl ether (diglyme) low-pressure discharges are very attractive for several industrial applications. Under a certain conditions they can have high biocompatibility and non-fouling properties. Though films with similar properties can be produced by conventional chemistry; the chemically produced films are soluble in acid or basic solutions, which is a great disadvantage for biomedical applications. Material properties of diglyme films were extensively studied, but due to complex nature of plasma medium the deposition process and its kinetics is still not well understood.
In order to understand deposition mechanisms of diglyme plasma polymers it is important to correlate plasma properties (using plasma diagnostic techniques) with material characteristics.
In this work diglyme plasma was produced in a cylindrical stainless steel reactor with two parallel plate electrodes excited at 13.56 MHz. The discharge was operated from 1 to 30 W applied power with total pressure inside chamber ranged from 10 Pa to 30 Pa. The plasma was investigated using optical emission spectroscopy in actinometric method (A-OES) and electrostatic measurements with RF-compensated Langmuir probe technique. The principal transitions investigated by A-OES were CH (431.2 nm), CO (519.7 nm) and H (656.5 nm). It was observed that the relative intensity of all transition is proportional to applied power while is disproportional to the operating pressure. Electron temperatures were calculated and for RF power varying from 1 W to 30 W electron temperature varied from 0.20 eV to 1.60 eV. The value of electron temperature was increasing for higher applied power or lower operating pressure.

Keywords
Plasma
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low pressure