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Effect of wafers on measurement of gas temperature in RF plasma
VLADIMIR MILOSAVLJEVIC, NCPST & School of Physics, Dublin City University, Dublin, Ireland, DAVID KAVANAGH, STEPHEN DANIELS, NCPST, Dublin City University, Dublin, Ireland — Analyzing the optical emission spectrum of atomic fluorine and fluorine base molecules, a gas temperature is measured in an Oxford Instruments® RF plasma discharge. The experiments are conducted with silicon or photoresist wafers, as well without any wafer. The gas composition is pure SF_6 as well a mixture of SF_6 and O_2, the working pressure is 13 Pa and the flow for all gases is constant at 100 sccm. The RF power is changed from 75W to 300W. The dependence of gas temperature on the chemical structure of surface/wafer, RF power and gas composition ratio between SF_6 and O_2 is investigated. The gas temperatures were determined by recording molecular bands of SiF (436.82 nm) and CF_2 (248.7 nm), and the spectral line of F (703.75 nm). Since a rotational temperature has been used widely as a neutral gas temperature measurement in different types of plasmas, in this work we present a correlation between gas temperature determinate by molecular bands and atomic spectral lines. We have only direct control of SF_6 and O_2 gases, therefore the contribution of carbon and silicon in the plasma discharge is indirectly controlled only by the RF power. The results show that for some specific ratios of SiF_6 and O_2 the neutral gas temperature via molecule bands is difficult to determine.

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