

DETERMINING CONCENTRATIONS AND TEMPERATURES IN SEMICONDUCTOR MANUFACTURING PLASMAS VIA SUBMILLIMETER ABSORPTION SPECTROSCOPY

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Plasmas used in the manufacturing processes of semiconductors are similar in pressure and temperature to plasmas used in studying the spectroscopy of astrophysical species. Likewise, the developed technology in submillimeter absorption spectroscopy can be used for the study of industrial plasmas and for monitoring manufacturing processes. An advantage of submillimeter absorption spectroscopy is that it can be used to determine absolute concentrations and temperatures of plasma species without the need for intrusive probes. A continuous wave, 500 – 750 GHz absorption spectrometer was developed for the purpose of being used as a remote sensor of gas and plasma species. An important part of this work was the optical design to match the geometry of existing plasma reactors in the manufacturing industry. A software fitting routine was developed to simultaneously fit for the background and absorption signal, solving for concentration, rotational temperature, and translational temperature. Examples of measurements made on inductively coupled plasmas will be demonstrated. We would like to thank the Texas Analog Center of Excellence/Semiconductor Research Corporation (TxACE/SRC) and Applied Materials for their support of this work.