Vacuum Technology Division
Room Ballroom A - Session VT-TuP
Vacuum Technology Poster Session

VT-TuP-1 Analysis and Quantification of the Impurities in a 300mm Etch Tool Exhaust During an Oxide Etch Process with CF4 Under Plasma, ***Anup Kumar Doraiswamy**, C. Jennings,* Air Liquide*; N. Stafford,* air liquide*; P. Nguyen,* Air Liquide

The consumption of the etching gases, primarily perfluorocarbons, is expected to significantly increase in the near future to match the increasing demand of electronic devices. While the global warming potential (GWP) from the direct emission of these perfluorocarbons (PFCs) is known, the quantity and identity of the species generated from them in the etch chamber may not be well understood. These plasma generated species can also have high GWP, contributing to the greenhouse effect in addition to being detrimental to the air quality by affecting COX NOX levels, etc. Therefore the identification, quantification and abatement of these compounds is of increasing interest to both semiconductor manufacturers and environmental regulators. Our current study focuses on analyzing and quantifying the exhaust of a 300 mm commercial etch tool during an oxide etch process using standard etching chemistry such as CF4. In our experiments, the plasma etch tool has been supplemented with a quadrupole mass spectrometer (Q-MS) and infrared spectrophotometer (FTIR) to identify and quantify the concentration of species in the exhaust generated from the plasma etching process.

VT-TuP-2 Amorphous Carbon Thin Films: Influence of Hydrogen Contamination on the Secondary Electron Emission Properties, ***Carolina Adame**,* CEFITEC, NOVA School of Science and Technology, Portugal*; E. Alves, N. Barradas,* DECN and IPFN, Instituto Superior Técnico, University of Lisbon, Portugal*; N. Bundaleski,* CEFITEC, NOVA School of Science and Technology, Portugal*; P. Pinto,* CERN, Switzerland*; J. Deuermeier,* CENIMAT|i3N, NOVA School of Science and Technology and CEMOP/UNINOVA, Portugal*; Y. Delaup,* CERN, Switzerland*; I. Ferreira,* CENIMAT|i3N, NOVA School of Science and Technology and CEMOP/UNINOVA, Portugal*; H. Neupert, M. Himmerlich , S. Pfeiffer, M. Rimoldi, M. Taborelli,* CERN, Switzerland*; O. Teodoro,* CEFITEC, NOVA School of Science and Technology, Portugal

One of the major limitations for the luminosity of modern particle accelerators is the formation of electron clouds (e-clouds), which cause beam instabilities, rise in pressure and thermal load to the system. The formation of electron clouds start with seeding electrons that originate in residual gas ionization (by the beam) or photoemission (from the wall, induced by synchrotron radiation). The seeding electrons are multiplied in an avalanche process induced by electron acceleration towards the walls by the beam potential, eventually creating an e-cloud.

One strategy to reduce the formation of e-clouds, successfully applied at CERN, is coating of the accelerator walls with amorphous carbon (a-carbon), having low Secondary Electron Yield (SEY). However, in some cases the coatings may become contaminated by hydrogen during the deposition, causing SEY growth above the threshold for e-cloud formation. In this work we explore the mechanism behind the change of secondary electron emission properties of a-carbon coatings due to hydrogen contamination.

a-carbon coatings were produced on Si and quartz substrates by magnetron sputtering with different amounts of D_2 added to the Ar discharge gas, to study the influence of these contaminations on SEY and resolve it from the natural contamination by hydrogen. In addition to SEY measurements, the samples were characterized by Elastic Recoil Detection Analysis (ERDA), X-ray Photoelectron Spectroscopy (XPS) and Optical Absorption Spectroscopy (OAS), providing information about their elemental, phase composition, and electronic structure.

The relative amounts of deuterium and hydrogen from the residual gas incorporated into the a-carbon thin films was quantified by ERDA. This incorporation increased SEY, and contributed to the deposition of non-uniform films, consisting of graphitic, diamond-like and hydrocarbon phases (as revealed by XPS). The SEY and optical energy gaps (determined using Tauc plots) increase with the amount of incorporated deuterium. The latter seem to be related with the amount of the graphitic phase in the samples: samples with higher graphitic-carbon fractions have lower SEY and higher light absorption, showing that graphitic regions work as energy absorbers for both light and secondary electrons. Increase of hydrogen species in the samples reduces the graphitic content, thus increasing SEY and light transmission.

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