

SiO₂ Etching Studies in Inductively Coupled C₄F₆ Plasma

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Low pressure fluorocarbon plasmas are commonly used in microelectronics fabrication of plasma etching of dielectric materials such as silicon dioxide and silicon nitride. Recently, one of the critical issues in fluorocarbon plasma is to achieve the deep contact etching with the ultra high aspect ratio due to the decrease of the design rule up to few ten nanosize. In these processes, the fluorocarbon gases have been used with numerous additives (e.g., O₂, CO, and Ar) to optimize the reactant fluxes and delivery of activation energy. Due to the inherent complex plasma chemistry, the process engineers still suffer from the absence of the robust and predictable modeling tools in this field. In this work, we present results from a computational and experimental investigation of the plasma chemistry and surface reactions in ICP (Inductively Coupled Plasma) sustained in Ar/C₄F₆/O₂ mixtures. Our strategy was to validate the model using measurements first made in only C₄F₆ ICPs, and then in plasma with more complex chemistry such as Ar/C₄F₆, C₄F₆/O₂ and Ar/C₄F₆/O₂ mixtures.