The Evaluation of Hexafluoro-1,3-butadiene as an Environmentally Benign Dielectric Etch Chemistry in a Medium-Density Etch Chamber

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The semiconductor industry faces a challenge in minimizing the emissions of global warming gases from dielectric plasma etch processes. Due to the rapid growth in the volume of IC production and the industry movement toward inlaid metallization with more levels of dielectric etching, global warming emissions will be of greater concern. As a result of this, several families of alternative chemistries are being considered as a replacement for perfluorocompounds currently being used by the industry such as CF_4, C_2F_6, C_3F_8, and c-C_4F_8,. One family, the unsaturated fluorocarbons (UFCs), holds particular promise. In this work hexafluoro-1,3-butadiene (C_4F_6) has been evaluated for silicon oxide and organosilicate glass (OSG) via etch on a medium-density magnetically enhanced reactive ion etch chamber (MERIE). The process and emissions results are compared to PFC-based processes on both high- and medium-density etch chambers. For oxide etching, global warming emissions reduction as high as 82% were attained compared to a c-C_4F_8-based process, with similar process performance achieved. In the case of OSG etching, a 65% reduction was possible compared to a c-C_4F_8 process.