Development and Evaluation of the ATMI CDO™ 865 for Abatement of Low-K Process Effluents

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ATMI has embarked upon a product development project to determine the optimal abatement solution for 200mm and 300mm barrier low-k and ILD bulk low-k processes utilizing trimethylsilane (3MS), tetramethylsilane (4MS), tetramethylcyclo- tetrasiloxane (TMCTS), and dimethyl-dimethoxysilane (DMDMOS). Utilizing typical process flows and process chamber effluent data provided by tool OEMs or end-users, ATMI set out to optimize the CDO™ Model 865 thermal/wet integrated scrubbing system for maximum abatement of process gases and their byproducts, while minimizing the production of unwanted byproducts. Via modification of an existing CDO™ configuration, ATMI was able to optimize the existing hardware and operating parameters to achieve excellent abatement results. The final low-k abatement data, measured via Fourier transform infrared (FTIR) and quadrupole mass spectrometry (QMS) techniques in the ATMI applications laboratory, will be presented.

The standard CDO™ Model 865 with dual PFC (perfluorinated compound) inlets and hydrogen reagent was chosen as the most suitable system for the low-k and barrier applications. The configuration was chosen due to past abatement performance gleaned from a limited data set, as well as proven laboratory performance upon hexafluoroethane (C_2F_6) and nitrogen trifluoride (NF_3), both of which may be utilized in the low-k process chamber clean recipes. Initial tests were performed utilizing a standard CDO™ system, and performance deficiencies were remedied through the addition of fuel and patent-pending mechanisms for oxidation enhancement and particulate remediation. The majority of the data was collected with the optimized system, although some results for both the standard and enhanced systems are included to illustrate the improvement in abatement performance.

In all cases, the low-k materials were abated to below detection limits, resulting in abatement efficiencies of >99.9% for all species. Additional advantages of the CDO™ 865 Low-k system included the absence of hazardous byproducts in the forms of NO_x and OF_2, as well as minimization of CO emissions.

Biographies

Belynda Flippo is Manager of Applications Engineering at ATMI. She received a B.S. in Chemistry at University of California at Davis in 1988 and has been employed at ATMI since 1995. Her experience and current focus include abatement product development and analytical systems integration.

Robbert Vermeulen is Manager of the ATMI Applications Lab in San Jose. He received a B.S. in Chemistry from Colorado State University in 1979 and has been employed at ATMI since 1999. Prior to working for ATMI he did research in polymer chemistry for Dow Chemical. His current work includes abatement system development and testing.