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Mass spectrometry with Knudsen cell applied to the investigation of organometallic precursors vapors

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A special Knudsen cell reactor coupled to a mass spectrometer, was specifically designed for the study of organometallic precursors. This reactor is built as tandem cells: an evaporation cell and a cracking cell. This reactor tries to simulate the conditions found in the bubbler of the ALD system by the evaporation cell and in the hot reaction zone of ALD by the cracking cell. The first stage reactor - an evaporation cell - provides an input saturated vapor flow operating from room temperature to 333 K. The second stage cell, named cracking cell, operated from 333 to 723K in the present study. During experiments, the effusion orifice is externally opened for direct mass spectrometric measurements of saturated vapour pressures. The device has been tested using the well-known mercury system. The thermal cracking of the gaseous precursor pentakis dimethylamino tantalum (PDMAT), generally adopted in the ALD/CVD TaN deposition processes, has been studied in the temperature range from 343 to 723K. Experiments showed the apparition of many gaseous species when cracking temperature increased and in particular the dimethylamine, HNC2H6 (g), corresponding to the saturated organic branches of PDMAT. Decomposition products of the HNC2H6 branch were observed at relatively high temperature, namely above 633K. This gas phase study - as for the saturated preceding one- shows the presence of oxygen containing molecules in PDMAT cracked vapor. Thus it allows explaining the systematic presence of oxygen contamination in the deposited TaN films observed in ALD/CVD industrial processes.

Biography

Ioana NUTA received her Ph.D from Orleans's University (France) in 2005 working on fluoride molten salts baths at high temperature by NMR spectroscopy in CNRS-CEMHTI Laboratory. She then completed a post-doctoral fellowship at ENSI Caen (2006) in CNRS-LCS Laboratory and at BRUKER (Germany) in department of NMR probe devellopement for catalytic studies. Since 2007, she joined CNRS- SIMAP Laboratory as reasercher in "Thermodynamic and Process Optimization" team where she has in charge the themodynamic studies on gaseous phase using Knudsen effusion Mass Spectrometery. Current studies focus on thermodynamics of organometallics, molten salts and oxides.

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