



## Chemistry Departmental Seminar

### Robert (Bob) G. Syvret, Ph.D., FACS

Principal/Owner, Fluorine Chemistry and Technology, LLC, Allertown, PA, USA

Thursday, August 22, 2024 at 1:00 p.m. (Room: CSF-1302)

**Title:** Fluorine Chemistry and Technology (F2ChemTech) LLC and EFC Gases and Advanced Materials

**Abstract:** Processing of semiconductor materials that are used in the fabrication of integrated circuits and computer chips is heavily dependent on the use of many different fluorochemical products employed at various critical stages throughout the fabrication lifecycle. For example, WF<sub>6</sub> is used for tungsten metal deposition; NF<sub>3</sub> and other fluorocarbons are used for chamber cleaning; and many different fluorocarbons, including fluoroalkanes and hydrofluorocarbons are used for various reactive-ion etching steps that collectively create the intricate electronic circuitry on a silicon wafer that results in a computer chip. And the semiconductor industry's dependence on fluorine technology has never been stronger than it is today. For example, atomic layer deposition, ALD, is a well-known and widely used technology for precision control of atomic layer by layer deposition. The complimentary process, atomic layer etching (ALE), has emerged as a critical enabling technology required for controlled and systematic layer by layer etching of device features as the required dimensions shrink to well-below 10 nm. One area of great need and especially for thermal ALE is the development of new fluorinated materials and methodologies that will improve efficiency, selectivity and self-limiting characteristics while reducing cycle times and collateral damage that is so often the result when plasma-assisted ALE processing is employed.

In addition to the "common" fluorochemicals traditionally used in semiconductor materials processing, there currently are several emerging fluorine compounds under development that provide both sustainable and environmentally friendly alternatives to the legacy materials used in semiconductor technology. An overview of fluorochemicals' importance to the electronics industry including some recent advances in technology development will be highlighted in this presentation.