



CHEMISTRY/PHYSICS SEMINAR SERIES

Dr. Seán Barry

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Wednesday, February 11th, 2026

11:00 a.m. to 11:50 a.m. in ENW 115

Design Rules of Molecules, and Why You Should Break Them

ABSTRACT

One of the less studied aspects of newly discovered molecules is their thermal behaviour. Melting point used to be a standard metric, before the easy access to NMR and combustion analysis made composition and purity very easy to measure. My research centres on designing organometallic compounds as volatile precursor compounds to make thin films by atomic layer deposition (ALD). Here, the melting point and decomposition temperature are important, and can be measured by differential scanning calorimetry, while the volatility and some decomposition mechanism can be understood from thermal gravimetric analysis. In the world of ALD research, this means people want sufficiently stable, high volatility compounds that react at a solid surface to make a film. This talk will describe the design rules for ALD precursors, and how to use them, and when to break them. Examples will include Mo(VI) and Au(I) compounds for metal thin film deposition, as well as carbenes for controlling the surface energy of surfaces, to enhance or stop deposition.

BIOGRAPHY

Seán Barry is a Full Professor at and Chair of the Department of Chemistry at Carleton University, where he works on precursor compounds for atomic layer deposition (ALD). He was trained in inorganic synthetic chemistry by Darrin Richeson and spent three years working on chemical vapour deposition (CVD) and ALD precursors in the group of Roy Gordon. He was instrumental in the design and synthesis of the well-known copper amidinate dimers that were instrumental for copper CVD/ALD in microelectronic applications. He started in Carleton University in 2003 working on guanidates of the group 13 metals (Al, Ga, In), and has recently studied guanidates, iminopyrrolidates and carbenes of the coinage (Cu, Ag, Au) and mid-transition (Co, Mo, Ru, W, V) for depositing thin films of these metals. His group works mainly on the mechanisms of thermal decomposition and thin film deposition and have invented several novel characterization methods to better understand mechanism. He was previously the founder and Senior Scientific Advisor for Precision Molecular Design. He is also the director of the CuNanofab, Carleton's nanofabrication facility. He is recognized as a world expert in metal ALD and precursor design with over 100 papers and 14 patents or patent applications. He has long-standing and extensive industrial collaborations in ALD, including Intel, LAM Research, ASM, Tokyo Electron Limited, and SK hynix. He is on the advisory board for the ACS journal Chemistry of Materials. He has served as a scientific advisor for the ALD for Industry, AVS ALD, Baltic ALD, and EuroCVD meetings, and was a co-organiser of the joint EuroCVD/Baltic ALD meeting in Linköping, Sweden in 2017. In 2012, he was awarded a Marie Curie Fellowship as part of the EU-funded European Research Training Network ENHANCE to undertake metal ALD at the University of Helsinki, and in 2015 he was awarded a \$295k Vinnova VINNMER Mobility grant to undertake CVD/ALD research in Sweden. He wrote a textbook entitled "Chemistry of Atomic Layer Deposition", published in 2022.