# Centre for Advanced Photovoltaic Devices and Systems (CAPDS)

<http://www.capds.uwaterloo.ca/>

## **CAPDS** promotes cutting-edge research and development that spans the spectrum of photovoltaic (PV) technology. Our 14,000-square-foot facility includes infrastructure for synthesizing semiconductor base materials; developing nanotechnologies for PV; designing and fabricating advanced PV devices and modules; and testing and characterizing PV materials, devices and systems.

## Location

ERC 1st floor

## Management

Director:

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## Users

* Faculty Collaborators (Electrical and Computer Engineering; Mechanical and Mechatronics Engineering; Chemistry)
* Collaborative R&D projects with other universities:
	+ University of Toronto
	+ McMaster University
	+ University of Western Ontario
	+ Concordia University

## Research

* Silicon Crystal Growth
* Non-planar Crystal Techniques
* Semiconductor Material Improvement
* Thin-film Semiconductor Materials
* Device Design
* Photovoltaic Device Technology
* Semiconductor Nanostructures and Quantum Dots
* Structural and Optical Properties Nanostructures
* Nano Photovoltaics
* Health and Safety of PV technologies
* Photovoltaic Modules
* Back-end Power Conditioning

## Selected Projects

## Equipment

* Crystal Growth and Wafering Lab: Czochralski crystal puller; Inner diameter (ID) wafer saw; Ingot shaper, Wire-saw for silicon ingots; Walking Beam Furnace; Wafer polishing station; Wafer dicing machine.
* Thin-film Deposition Lab: Plasma-enhanced chemical vapor deposition (PECVD), Low-pressure chemical vapor deposition (LPCVD), Electron-beam and Thermal evaporation, Radio frequency (RF) and DC sputtering.
* Bulk Semiconductor and Thin-film Characterization Lab: Microwave Photoconductivity Decay Measurement (µ-PCD); Laser Beam Induced Currents (LBIC); Hall Effect Measurement; Four point probe; Non-contact Resistivity Mapping; Deep Level Transient Spetroscopy (DLTS);  Spectroscopic Ellipsometry; Wide-band Spectrophotometer; Extended range Infra-red Spectrometer with Hyperion Microscope.
* Nano-PV Lab: Specialized Glove-box and Wetbenches; Plasma and Thermal CVD tools for Nanowire Fabrication; Electron-beam Writing; Tools for Chemical Synthesis and Quantum-dot Embedded Layers; Centrifuge, titrator, shaker, high-speed shaker.
* Nano-materials Characterization Lab: Steady-state and Lifetime Fluorimeter Photoluminescence (PL) System with Quantum Yield, Cryostat and Fluorescence Microscope; Electron Back-scatter Diffractometry (EBSD); Cathodoluminescence (CL); Scanning Electron Microscope (SEM); Electron Beam Induced Current (EBIC).
* PV Device Fabrication Lab: High Temperature Four-stack Furnaces for Dopant Diffusion, Annealing, and Oxidation; Spin Casting Stations; Rapid Thermal Processor; Mask Aligner; Photolithography; Surface profilometer; Wet chemical Processing; Electro-chemical Etching Station; Reactive Ion Etcher; PECVD Thin-film Deposition; Anti-reflection Coatings.
* PV Device Characterization Lab: Quantum Efficiency Measurement; Integrated Sphere Reflection; Probe Station; Dark Current-Voltage (I-V) Parametric Analyzer; High Frequency and Quasi-static Capacitance-Voltage (C-V) Measurement; Solar Simulator.
* Screen-printing Metallization Lab: Semi-automatic Fine-line Screen-printer with full alignment capability; Drying Ovens; Infra-red Firing Furnaces.
* High Throughput Processing Lab: Conveyor Belt Furnaces; Large Area Processing.
* PV Module Fabrication Lab: Module laminator; Lay-up Table; EVA Optical Characterization.
* Design and Simulation Software: Computing facilities; Design Tools for High Efficiency PV Device Architectures; Simulation Software for PV System Performance and PV-hybrids.

## Supporting Partners

* UW
* Industrial funds
* CFI
* Ontario Innovation Trust
* NSERC (Strategic Grants, Discovery Grants, Strategic Networks)
* OCE
* ORF (Research Excellence)