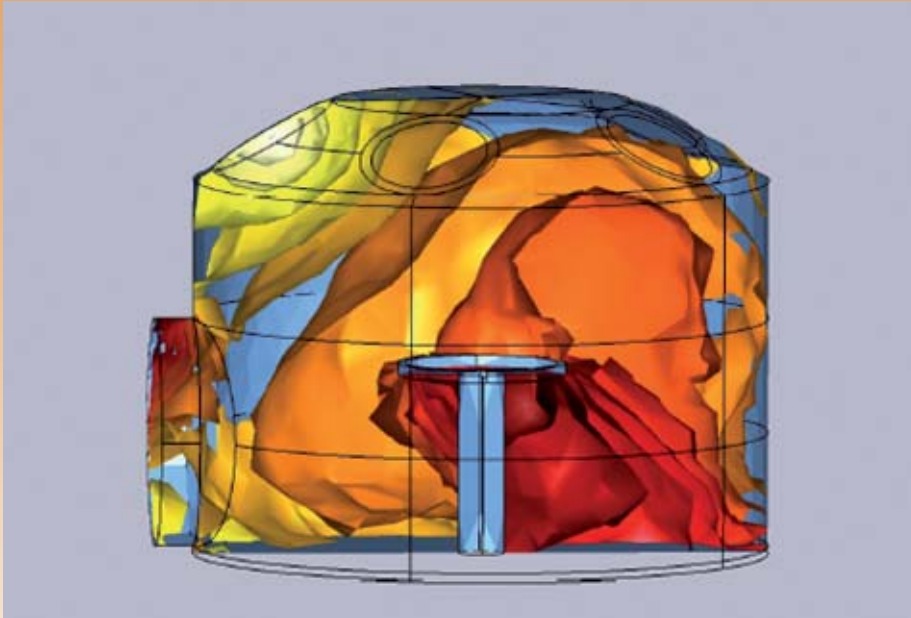


VACUUM PROCESSES & EQUIPMENTS

Computer Assisted Engineering
Professional Services



PHYSICAL SIMULATION SOLUTIONS

From **thin film solar cells** to **architectural glass**, from **semiconductor** to **hard disk drives**, vacuum process equipments are nowadays ubiquitous. Their inherent complexity, large development and ownership costs, make Computer Assisted Engineering (CAE) a strong value proposition across their whole industrial lifecycle. However, commercially available CAE platforms are missing key physical models to really help solve your most critical issues when designing and optimizing vacuum process equipments

*Leveraging on its unique and proprietary atomistic Physical Simulation software platform, In Silicio can be your CAE service partner to better solve your most difficult and critical vacuum process and equipment engineering issues : **gas flow optimization, process uniformity optimization, contamination control...***

Value Propositions

- Would you like to **virtually prototype several gas injection / pumping configurations** for your next generation vacuum tool, at a fraction of the cost and time needed for a single hardware prototype ?
- Would you like to optimize in a matter of days your latest **magnetron design**, to achieve unprecedented level of deposition uniformity and target utilization ?

- Would you like to establish a **virtual prototyping platform** with your equipment partners to speed up the development of the **unique PVD tools** required for your soon to be started **multi tens of MW thin film solar cell factory**?
- Would you like to be the first on the market with a best **in class evaporation source** for the latest rapidly growing application?

In Silicio application engineers will effectively interact and support your engineering team with accurate and predictive Physical Simulations, helping you delivering better products, sooner, cheaper.

Featured capabilities

Full Support for Complex 3D Equipment Geometry

- Give us your mechanical CAD files we do the rest (support for direct CAD file imports)
- Best in class geometry engine allowing for efficient, scripted, and parametric set up of complex 3D geometry
- Fully unstructured 3D tetrahedral computational mesh is automatically generated

Accurate Gas Flow Modeling in Transition / Ballistic Regimes (Low Pressure)

- Classical Computational Fluid Dynamic (CFD) packages are not providing you accurate results in the pressure range of interest
- Our unique and proprietary Direct Simulation Monte Carlo (DSMC) solver delivers accurate and predictive gas flow simulations in transition and ballistic regimes
- Accurate modeling of gas phase atomic and molecular collisions, surface interactions (scattering, condensation...)
- Support for gas mixtures
- Gas injection from reservoirs (fixed P and T), or from a more complex CFD modeled inflows
- Effective model for outflows to pumps (pumping speed boundary condition)

Evaporation Sources Modeling

- Accurate modeling of atomic and/or molecular processes at liquid / gas interfaces
- Extraction of angular flux distribution at source outlet

Magnetron Sources Modeling

- Support for realistic complex 3D magnetron geometry
- Accurate 3D magneto-static field solutions
- Electron, ions, neutrals accurately tracked in 3D electro-magnetic force fields
- Quantitative and predictive simulations of target erosion and deposition uniformity

PVD Chamber Modeling

- Chamber level modeling of gas flows and deposition processes
- Quantitative and predictive simulations of deposition uniformity on substrate, depending on source placement, process conditions...
- Quantitative and predictive simulations of chamber wall depositions

Applications

Optical Coatings

- Evaporation, sputtering, ion beam tools design and optimization
- Optimization of source and substrate placements for better coating uniformity
- Screen geometry optimization for better coating uniformity

Molecular Beam Epitaxy Tools

- Optimization of crucible geometries for better angular flux distribution stability
- Optimization of gas injectors / crakers
- Optimization of source placements for better deposition uniformity

PVD Tools for Semiconductor and Data Storage Applications

- Optimization of gas injection / pumping configurations
- Design and optimization of magnet arrays for better target utilization, better deposition uniformity

Glass Coatings

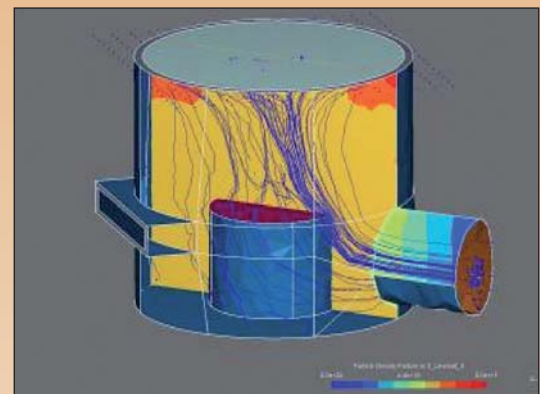
- Gas flow simulations to mitigate unwanted inter-chamber gas mixing in linear coaters
- Magnetron optimization to maximize target utilization (cross corner effect mitigation)

Thin Film Solar Cells

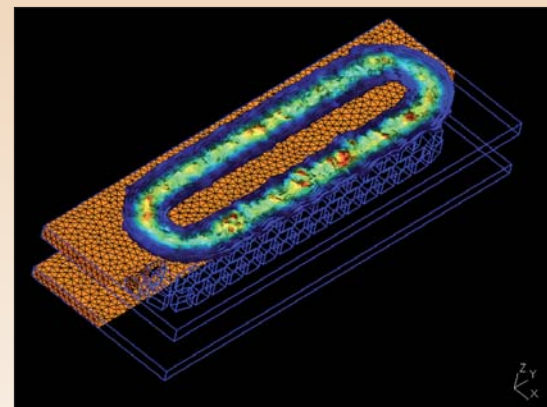
- Gas injection and pumping configuration optimizations at the process module level
- PVD source design and placement for deposition uniformity and source utilization optimization
- Selenium sources design and placement for CIGS deposition uniformity optimization
- Optimization of Selenium confinement and abatement solutions for CIGS process tools



In house high performance Linux cluster and Distributed Analysis capabilities enable fast turn around of complex simulation projects



*Transition gas flow simulation in PVD chamber
Gas injection and pumping configuration optimization*



*Linear Magnetron Simulation
Optimization of deposition uniformity and target erosion uniformity*

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730 rue René Descartes
F-13857 Aix en Provence cedex 3