

SpinGrower™

Desktop Layer-by-Layer
Assembly System

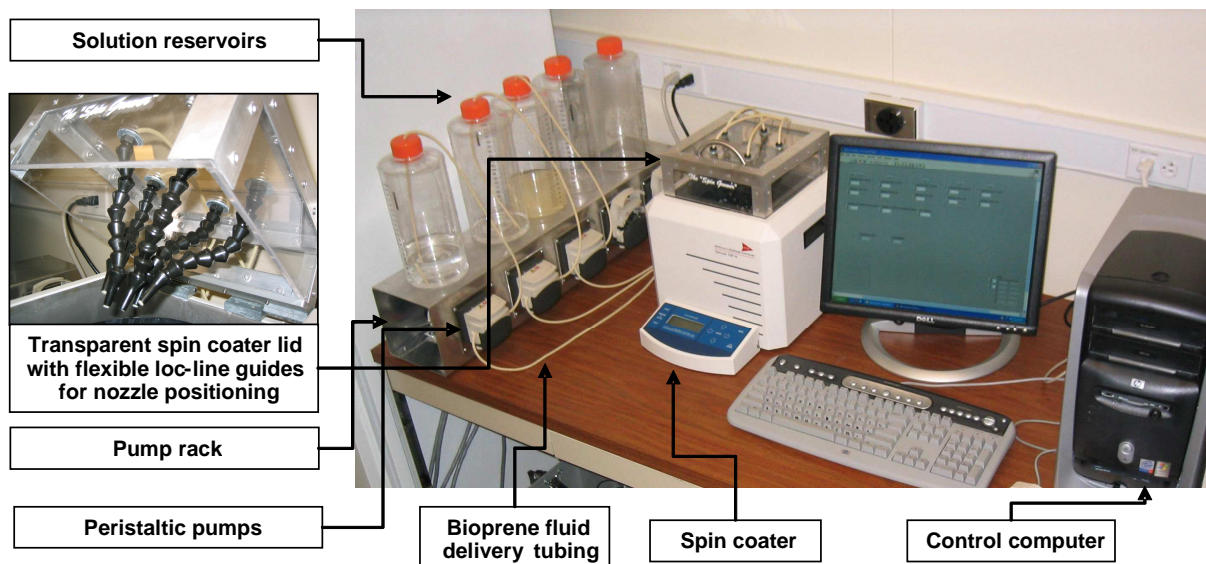
| **NANO** |™
Absolute Nano



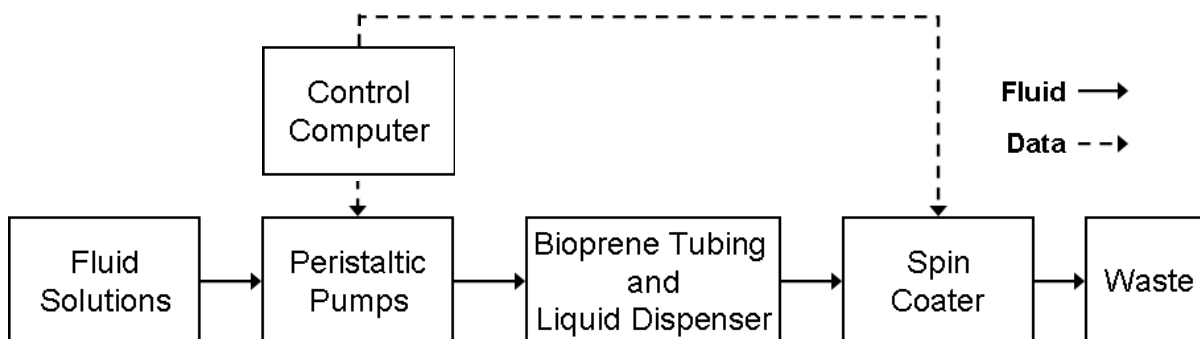
SpinGrower™ Desktop Layer-by-Layer Assembly System

Absolute Nano introduces the SpinGrower™ – a versatile tool for deposition of multilayer thin films from liquid solutions, including by layer-by-layer (LBL) assembly. Applications include production of multilayer nanostructured thin films and nanocomposite coatings from charged polymers, nanoparticles (metallic, semiconducting, insulating), nanofibers (nanotubes, nanowires), nanoplatelets (e.g., graphene, clays), and other supramolecular species. The system accommodates substrates with diameters up to 6 inches (15.2 cm) and achieves assembly times orders of magnitude faster than conventional dip LBL systems. The SpinGrower is fully automated and can be preprogrammed for an indefinite number of layers, with control of the deposition sequence, the dispensed volume, and the substrate spin rate for each step.

SpinGrower Features and Benefits



SpinGrower system, showing major components and close-up image of spin coater cover with flexible fluid delivery tubing.



SpinGrower system diagram, showing the flows of fluid and data.

- **Rapid production of high quality films** is enabled by the spinning substrate. The SpinGrower is an order of magnitude faster than competing products that use conventional dip-LBL methods. For example, to produce 300 bilayers of PVA/clay film, it takes five hours using the SpinGrower while conventional dip-LBL takes five days. The SpinGrower thus enables rapid prototyping of new nanocomposite thin films with highly ordered molecular structures. The growth rate is much faster than that of traditional dip LBL methods, while bilayer thickness is comparable to traditional techniques. .
- **Adaptable number of solutions and process steps** allows up to five different flow channels and solutions to be introduced in any user-specific sequence. For example, the SpinGrower allows user to decide the type and number of chemicals to be used

while bypassing the extra lines. If the user chooses to use three types of chemicals, only three lines will be used.

- **Variable substrate size and shape**, including glass microscope slides, is made possible with an optional vacuum chuck adaptor. The standard vacuum chuck will accommodate **large substrates** up to a diameter of 6 inches (15.2 cm).
- **Fully articulating fluid delivery tubing** allows absolute freedom of location and injection angle for each fluid independently. The flexible tubing allows the user to choose the location at which the fluid is injected on to the spinning substrate as well as the angle of injection, which may affect the uniformity of the film.



The SpinGrower's flexible fluid delivery tubing

- **Automated fluid injection** is enabled by the SpinGrower program. It features **controllable spin speed** from 1000-10000 RPM for each coating sequence and **variable fluid flow rate** up to 1.2 mL/s. For example, user may specify the substrate spin speed to be 4000 RPM for the first 100 bilayers, 7000 RPM for the subsequent 200 bilayers, and returning to 4000 RPM for the remaining 200 bilayers. The program is also equipped with a **safety emergency stop button**.
- The SpinGrower program also features a **drip prevention** function that can be calibrated to withdraw any impending drips at the nozzle tips after each delivery. Users do not need to worry about excess fluid drip caused by the inertia of the rotating pump.
- When the lid is closed, the **substrate is fully viewable for *in situ* optical observation**. The transparent polycarbonate lid allows for real-time thickness measurement by mounting an ellipsometer or laser displacement sensor on top of the spin coater. (Note: Instruments for thickness measurement are not provided)
- It has also been shown that the films produced by the SpinGrower have **enhanced structural order** [1]. For example, comparing PVA/clay film by dip-LBL and spin-LBL, small angle X-ray scattering (SAXS) results indicate that the spin-LBL method reduces the intercalation of polymer between clay sheets. The clay platelets in the

spin-LBL film display higher orientation than that in the dip-LBL sample. In dip-LBL the components are simply adsorbed onto the surface, and the minimization of surface energy results in the orientation of the clay platelets parallel to the substrate. For spin-LBL the high fluid velocity over the substrate creates shear forces during the film deposition, resulting in the increased orientation of the clay platelets [1].

- [1] S. Vozar, Y.C. Poh, T. Serbowicz, M. Bachner, P. Podsiadlo, M. Qin, E. Verploegen, N.A. Kotov, A.J. Hart. Automated spin-assisted layer-by-layer assembly of nanocomposites. *Review of Scientific Instruments* 80:023903, 2009.

SpinGrower System Specifications

Specification	Value
Overall footprint	1.8 X 1 m ²
Substrate spin speed	0 - 10,000 RPM
Maximum fluid injection rate	1.2 mL/s
Maximum substrate diameter	15.2 cm
Number of solutions	5
Reservoir capacity (per solution)	2 L

SpinGrower Component Specifications

Spin system	
Spin coater (width x length x height)	30.5 X 42 X 35.6 cm
Spin coater max rotational speed	10000 rpm
Spin coater acceleration/deceleration to set point	25.5s in 0.1s increments
Fluid delivery system	
Peristaltic pump (width x length x height)	8 X 12 X 8.5 cm
Peristaltic pump max speed	300 rpm (1200 mL/min)
Pump rack (width x length x height)	30.5 X 122 X 30.5 cm
Delivery tube (length X OD X ID)	10 m X 4.8 mm X 1.6 mm
Delivery tube material	Bioprene
Fluid container	2 liter PETG bottles
Control system	
SpinGrower program (software not included)	LabVIEW
Integrated Control Box with 24 VDC power supply (width x length x height)	61 X 61 X 30.5 cm
Support system	
Glass slide chuck adaptor (OD X height)	8 X 0.6 cm
Glass slide chuck adaptor material	Delrin
Waste tube (OD)	1.9 cm
Waste tubing material	Vinyl

Ordering Information

Item	Part Number
SpinGrower Desktop Layer-by-Layer Assembly System (Includes: Spin system, Fluid delivery system, Control System)	1100-00005
Microscope Glass Slide Chuck Adapter	2100-0005

For more information, please contact:

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