PILOT AND VOLUME PRODUCTION PLD

SOLMATES' UNIQUE SOLUTION FOR STABLE AND COST EFFECTIVE THIN FILM MANUFACTURING

SOLMATES
THIN FILM EQUIPMENT

Solmates PLD for MEMS, RF, sensors & actuators, OLED, PV

Solmates mission, as a fast growing and ambitious OEM company, is to position pulsed laser deposition (PLD) as a mainstream thin film deposition technology equal to ALD and sputtering.

THE SOLMATES PROPOSITION

Thin film deposition techniques are applied in a wide variety of markets like MEMS, semiconductor, PV, OLED and RF. Upcoming technology nodes and development roadmaps are increasingly leaning on novel material systems with specific properties, rather than scaling-down on lithography precision to increase computation density. New complex material systems with increasingly critical material properties ask for constant expansion and quality improvement of thin film deposition technologies, supporting a wider range of thin film processes while also enabling extended flexibility in process optimization.Physical deposition technologies are famous for controlled growth kinetics, leading to new possibilities to tune thin film microstructures enhancing the materials properties. Pulsed Laser Deposition (PLD) supports both complex material processes and has a high degree of freedom in terms of process variability to support both needs. Solmates PLD enables the use of this versatile technology on as large as 300mm substrates, with defect densities that match specifications of high-volume manufacturing environments. Combining years of material synthesis experience with robust and user-friendly deposition equipment, Solmates is the partner to drive your development beyond the next technology node.

COMPANY

Solmates is a fast-growing equipment supplier of thin film deposition tools based on Pulsed Laser Deposition (PLD). The company started in 2007 as a spin-off from the MESA+ Institute for Nanotechnology, located at Science Park Twente in the Netherlands. Since 2020 Solmates is scaling up production of its unique PLD equipment, to supply high volume manufacturing equipment to different thin film markets worldwide. The Solmates team consists of highly recognized specialists, combining highly recognized scientific knowledge and a track record with well established semiconductor companies.

MARKETS

New applications and markets are demanding continuous improvement of deposition technology to address the new challenges in thin film processing. The availability of high quality PLD processes on substrate sizes up to 300 mm, allows our customers to extend their thin film deposition capabilities addressing new possibilities to solve these challenges. The Solmates team has developed several thin film processes with a focus on product enhancement, integration, process stability and attractive process economics. Solmates combines these thin film processes with its IP-protected hardware to support integration of our layers into your application.

PRODUCTS

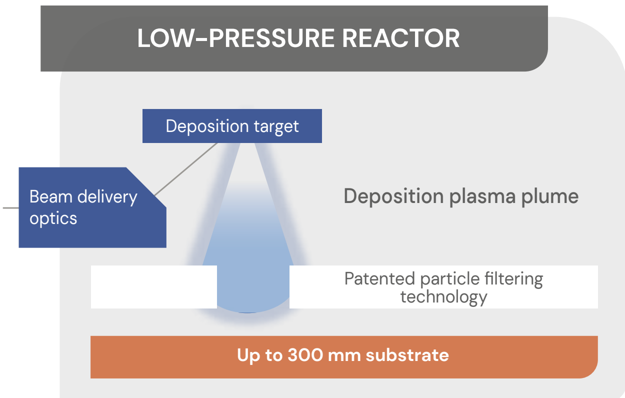
The Solmates PLD platform offers high flexibility in terms of hardware engineering, allowing us to provide a solution to every type of customer or application. The Solmates PLD platform can be integrated to any standard cluster frame to support high volume production but can also be installed as stand-alone platform for process development and pilot production. Flexibility in substrate size allows our PLD platforms to support every industry standard substrate size up to 300mm.

INTRODUCTION TO SOLMATES PULSED LASER DEPOSITION

PULSED LASER DEPOSITION: A VERSATILE DEPOSITION TECHNOLOGY

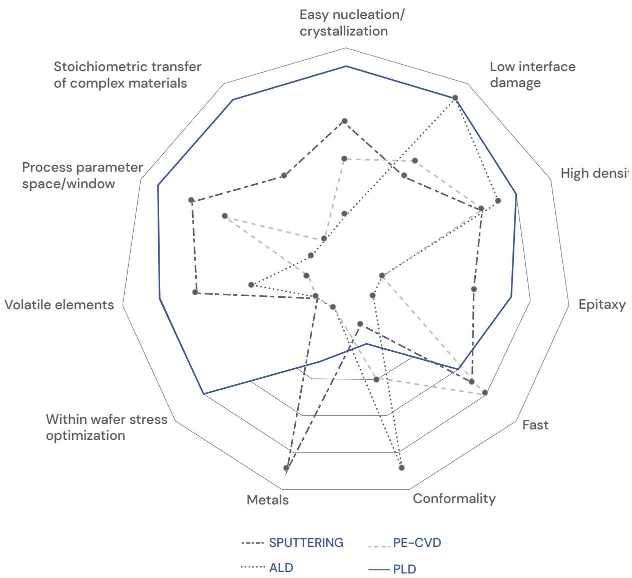
Pulsed laser deposition (PLD) is a physical vapor deposition method that uses high energetic laser light to energize material, creating a deposition vapor that can be condensed on any possible substrate. A pulsating UV-laser bundle is focused onto a deposition target which is positioned inside a vacuum chamber, leading to a very high local energy density on the surface of this deposition target. When this energy density exceeds a materials ablation threshold, the absorbed energy leads to expansion of the material perpendicular to the deposition targets surface, creating a plasma. In a typical PLD process, the energy focused on a deposition target's surface is significantly above the ablation threshold, giving the deposition species even more kinetic energy as they expand into the vacuum chamber.

The expanding plasma plume, consisting of excited atoms, small and large clusters, is condensed onto a wafers interface by placing the substrate in direct line of sight with the plasma. The high density and energy of the species inside the deposition plasma leads to the formation of metastable material phases that are associated with supersaturated film growth. This gives PLD an competing edge when it comes to material nucleation at the substrate interface. This leads to high crystallinity film growth at lower deposition temperatures, starting right from the first few nanometers. As PLD does not require any bias applied to the substrate or target, the technology is a very suitable deposition method for thin film growth onto different conducting and non-conducting substrates.



Further control over the deposition process occurs by influencing the plasma species as they travel towards the substrate. The use of reactive and inert gasses inside the vacuum chamber creates an opportunity to tune the deposition kinetics as well as the film stoichiometry, which influences the growth mechanism of the deposited thin film. It is this extensive freedom to control the growth kinetics during the PLD process that drive most of the powerful and unique advantages in PLD thin film processing, creating a window to tune film characteristics like microstructure, porosity, film stress or deposition damage as well as electrical and optical properties.

Another key advantage of PLD compared to other vapor deposition technologies is the possibility to deposit complex material systems with or without volatile elements, maintaining a good stoichiometric transfer of the material from target to substrate. Difficult materials like $LiNbO_3$ and KNN are easily deposited using PLD.



For more information on how Solmates can provide your thin film deposition solution, please contact the Solmates team.

Global service network, proven track record and process development support for your manufacturing needs

EQUIPMENT	
Substrate dimensions	Up to Ø300 mm
ubstrate shape	Round and square
Laser	KrF excimer laser
Beam delivery	Complete integrated optics
Process temperature	RT – 700°C
Substrate temperature-uniformity	<2%
Process gasses	O2, Ar, N2 – others on request (forming gas)
Particles	Active particle filtering technology

PROCESS SPECIFICATIONS	
Thickness uniformity	Up to Ø300 mm
WiW **WtW / RtR**	< 2 % 1s < 1.5 % 1s
Composition uniformity	< 2 % 1s

OPTIONS
• Host interface • Target library loadlock

MARKETS	APLLICATION/FUNCIONALITY	MATERIALS
OLED & LED	Anti-reflection, TCO's, barriers, passivation	Al_2O_3, AZO, HfO_2, IGZO, ITO, MgO, Mg-ZnO, Ta_2O_5, ZnO, ZrO_2
MEMS & NEMS	Sensing, actuation, acoustics	Al_2O_3, $BiFeO_3$, KNN, $LaNiO_3$, $PbTiO_3$, $Pb(Zr,Ti)O_3$, PMN-PT, $SrRuO_3$ $LiNbO_3$, ZnO, AlN, Sc:AlN, HfO_2
CMOS & power IC	High-k, passivation, barriers, spintronics	AlN, Al_2O_3, CeO_2, HfO_2, MgO, PZT, $SrTiO_3$, TiN, ZrO_2
Energy	SOFC, PV, batteries, thermoelectrics	YSZ, CIGS, Gd-CeO_2, ITO, $(La,Sr)(Co,Fe)O_3$, Li_xMnO_2, Li_xCoO_2, Na_xCoO_2, $Zn_{1-x}Al_xO$
Photonics	Electro-optics, IR-detection, waveguides, quantum computing, Pockels-effect (electro-optic materials)	Al_2O_3, $BaTiO_3$, ITO, $LiNbO_3$, PLZT, $Y_3Fe_5O1_2$, ZnO
Memory	MRAM	$BiFeO_3$, $CoFe_2O_4$, CrO_2 , LSMO, $MnFe_2O_4$, MnO
Conductors	Electrodes, reflectors, alloys, superconductors, metal-insulator transition, oxide electrodes	$Ba(Bi, Pb)O_3$, $LaNiO_3$, $SrRuO_3$, $SrLaCuO_4$, V_2O_3, $Yba_2Cu_3O_{7-x}$, ITO
Epitaxy	Templates, superlattices, 2D-materials	CeO_2, GaN, $LaAlO_3$, MgO, $SrTiO_3$, TiN, YSZ, MoS_2
RF & 5G	SAW, BAW, discrete devices (varactors, beam-steering, high-K)	AlN, BN, $BaTiO_3$, $Ba_{1-x}Sr_xTiO_3$, Sc:AlN, $LiNbO_3$

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