YES's Solutions for DNA Sequencing, Genomics and Microfluidic Devices

Industry Drivers

DNA sequencing has witnessed phenomenal growth in the past two decades. "Next Generation Sequencing" (NGS), which utilizes massively parallel sequencing, is driving a million-fold reduction in cost and even greater levels of time saving. Today, a human genome can be sequenced (as one of 48 being sequenced simultaneously) in 44 hours. This is effectively more than one genome per hour at around $1,000 each. Future sequencing applications will require even higher throughput, lower costs and greater accuracy to meet clinical demands. These improvements will enable new product offerings – with applications at point of care facilities and in non-laboratory field settings.

A generalized workflow for NGS

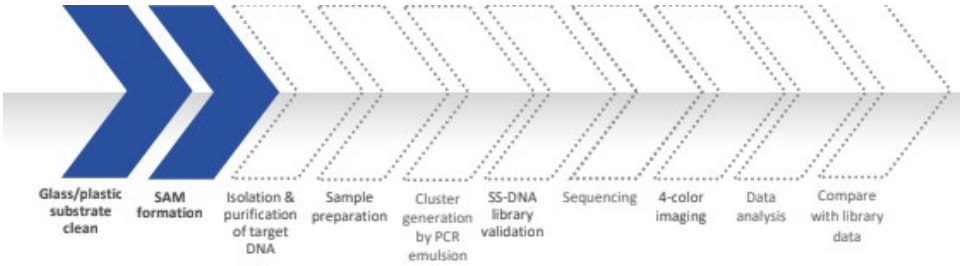
The NGS solutions of the future will need high accuracy, contamination-free sample preparation, sequencing device integration with other key steps in the workflow, and device miniaturization to achieve the goal of $100 per genome population-scale genomics.

Material used for these technologies include single-use plastics, glass substrates, and photolithography etched well structures or holes. Microfluidic chips will become more important, especially for single molecule technologies. While single molecule technology has a minority market share today, as the technology matures, it will need new solutions for materials, process & equipment, and device miniaturization.

Customer Needs

Sample preparation and reagents used during clonal amplification and sequencing steps can account for up to 80% of total sequencing costs (excluding bioinformatics). Suboptimal sequencing runs must be minimized and manufacturing quality tightly controlled.

A typical sequencing application flow cell fabrication process and downstream application could include multiple steps as shown below:



Steps in flow cell fabrication and typical genome sequencing application

For accurate and repeatable DNA sequencing results, it is important to have robust upstream fabrication processes. In particular, cleaning and surface preparation of flow cell substrates prior to attachment of DNA sequencing probes are critical steps. Application of specialized film coatings forming Self Assembled Mono-layers (SAM) enables precise covalent probe attachment.

Wet coating fabrication processes suffer from the following shortcomings:

- Higher coating reagent volume and increased cost
- Higher non-uniformity and higher background noise. As a result, more clonal amplification cycles are required to obtain “high signal to noise” data. This increases cost and instrument run time.
- Increased sequencing redundancy needed (higher sequencing coverage depth requirements and more repeat sample testing)
- Limited choice of materials and coating products.

On the other hand, the YES plasma-based cleaning process (for surface cleaning) and chemical vapor deposition (CVD)-based coating products (for SAM formation) provide leading genomics companies with significant advantages. These advantages include predictable and tunable cleaning and coating, high throughput fabrication, lower use of coating reagents, conformal treatment of surfaces and ultimately more predictable and reliable data generation. All these benefits are coupled with a focus on highly reliable, high volume manufacturing.

YES Products

YES provides equipment ranging from laboratory systems to High Volume Manufacturing (HVM) solutions to serve customers at any scale. Our Clean, Coat, and Cure product lines provide unique capabilities to enhance materials, surfaces and interfaces at micro- and nano-scale.

Clean: automated plasma photoresist strip/descum solution.

- >95% uptime (only 3 moving parts), higher throughput (no showerhead), and ~1/2 the footprint of comparable products in the industry.

Coat: for Silane Molecular Vapor Phase deposition with excellent repeatability and precision.

- 3x better temperature uniformity across the substrate, up to 2x improvement in contact angle variability, and a wide variety of applications including >100 chemical precursors.

Cure: vacuum-based, low temperature polymer curing.

- ~50% improvement in cycle time, 2x improvement in temperature uniformity, and low stress & outgassing

YES customers include industry leaders in the genomics sector, top-tier research institutions and the industry’s most respected technology incubators. YES works closely with these customers to develop custom solutions for their unique requirements including process development, equipment selection and post-sales service support. These efforts and associated product development initiatives are supported by YES’ state-of-the-art laboratory in the Silicon Valley.

How can YES assist you?

YES engineers are experts in controlled surface modification enabling several end markets: fabrication of silicon microprocessors, advanced packaging, (bio)MEMS, genomics, microfluidics, medical devices, and advanced technologies. For more information, please email sales@yieldengineering.com, call +1.925.373.8353 or visit www.yieldengineering.com

Seamless Lab-to-Fab HVM Production Solutions

Clean

G500/G1000 / CV200RFS
Plasma Clean System / 200mm Clean Manual

Plasma Clean

Photoresist Strip/Clean/Descum

ÉcoClean
200mm Clean Automated (*300mm coming soon*)

Photoresist Strip/Clean/Descum

Coat

ÉcoCoat 1224P / 58TA,310TA
HMDS and other Silane Vapor

HMDS Vapor Prime/Image Reversal

VertaCoat
Monolayer Vapor Deposition

Self Assembled Materials (SAM)
Silane/HMDS Prime before PR

Cure

PB Series Cure System
PB6/PB8/PB12 Vacuum Cure

Polyimide/BCB/PBO/Low Temp Polymer Cure

VertaCure
300mm Vacuum Cure (*Panel Available 2019*)

Polyimide/BCB/Other Polymer Cure