

## NNCI Etch Workshop 10 October 2018 NNCI @ Stanford

#### **BRUCE CLEMENS**



PROFESSOR OF MATERIALS SCIENCE &ENGINEERING DIRECTOR OF STANFORD NANO SHARED FACILITIES (SNSF)



nano@stanford supported under NSF award ECCS-1542152



nano@stanfo



#### **Facilities**



~30,000 ft<sup>2</sup>





# NNCI @ STANFORD



**Bruce Clemens**, Professor of Materials Science & Engineering, Director of Stanford Nano Shared Facilities (SNSF)



- Co-Pls:
- Curt Frank, W.M. Keck, Sr. Professor in Chemical Engineering



- · .
- Kate Maher, Assistant Professor of Geological and Environmental Sciences
  - Debbie Senesky, Assistant
    Professor of Aeronautics and
    Astronautics\*















- Key Participants:
- Tobi Beetz, Associate
  Director of Stanford Nano
  Shared Facilities (SNSF)
- Mary Tang, Associate
  Director of Stanford
  Nanofabrication Facility (SNF)
- Nick Melosh, Associate Professor of Materials Science & Engineering, Deputy Director of Stanford Nanofabrication Facility (SNF)
- Angela Hwang, Education & Outreach Program Manager (NNCI)
- Shiva Bhaskaran, External User Program Manager (NNCI)

### Expertise



National Nanotechnology Coordinated Infrastructure





#### Research







data: 2017 publication abstracts

## NNCI @ Stanford: User Data

Yearly User Data Comparison			
	Year 1	Year 2	Year 3 (6 months)
Total Users	1,142	1,287	1,096
Internal Users	952	1,027	818
External Users	190 (17%)	260 (20%)	208 (25%)
External Academic	36	41	26
External Industry	154	215	179
External Government	0	4	3
External Foreign	0	0	0
Total Hours	113,089	113,193	64,578
Internal Hours	94,996	91,248	50,941
External Hours	18,093 (16%)	21,944 (19%)	13,637 (21%)
Average Monthly Users	520	572	591
Average Ext. Monthly Users	74 (14%)	92 (16%)	105 (18%)
New Users Trained	542	579	274
New External Users Trained	89 (16%)	143 (25%)	95 (35%)



National Nanotechnology Coordinated Infrastructure





## External Users during 2017/18



## Sampling of external user affiliations



## Sampling of new external user affiliations



National Nanotechnology Coordinated Infrastructure





~ 70 new organizations signed up in 2018!

## External User: Bandwidth10

- Motivation: develop a low-cost optomechanical device using longwavelength vertical-cavity surface emitting lasers (VCSEL) technology for broadband optical communications
- Technique: fabrication of highcontrast-grating (HCG) mirror using Electron-beam Lithography followed by a wet chemical etch







#### About Bandwidth10

- Start-up founded in 2011
- Venture funding
- www.bandwidth10.com





Images of fabricated HCG-VCSEL devices

#### Bandwidth10 1550nm Tunable Transceivers

## External User: TwoPoreGuys



- Motivation: develop a single molecule detection platform on solid state nanopore technology for molecular diagnostics, genome mapping and DNA sequencing
- Technique: fabrication of single nano pore on SiN membrane using electron beam Lithography and etching

Fluid from blood or saliva containing DNA, RNA, proteins or antibodies is put on the two-pore chip. The ionic current measured across the pore shifts when DNA is driven through the pore.

#### About TwoPoreGuys

- Start-up founded in 2011
- Raised \$31.5M in venture funding
- <u>http://twoporeguys.com</u>









#### External User: San Francisco State University



- Motivation: develop submicron hyperuniform disordered photonic bandgap structure for photonic ICs
- Technique: fabrication of photonic crystal structure using EBL and etching

**Group Profile** 

- Prof. Weining Man (Physics & Astronomy)
- Research funded by NSF
- Why Stanford?
  - "EBL writes in other labs were not able to handle the pattern"
- <u>http://www.physics.sfsu.edu</u>



Waveguide running through Hyperuniform Disordered Structure (HUDS)









The couplers guide light through this waveguide. The HUDS pattern controls light propagation within the structure.

### **NNCI Etch Workshop**

Day 1 Agenda: Location - Paul G. Allen Building; Room 101

- 8-8:30am: Breakfast
- 8:30-8:40am: Welcome Prof. Bruce Clemens
- 8:40-9:00am: Stanford Usha Raghuram, Cliff Knollenberg
- 9:00-9:20am: Harvard Ling Xie
- 9:20-9:40am: Cornell Vince Genova
- 9:40-10:00am: Penn Gyuseok Kim
- 10:00-10:10am: Break/Vendor Exhibit
- 10:10-10:30: Washington Mark Morgan
- 10:30-10:50am: Georgia Tech Hang Chen
- 10:50-11:10am: Minnesota Tony Whipple
- 11:10-11:30am: Texas Sarmita Majundar
- 11:30-11:50am: UCSD Xuekun Lu

- 11:50-1:30pm: Lunch/ Vendor Exhibit
- 1:30-2:15pm: V.Genova-Cornell-"Pulsed ICP etching of Si with HBr"
- 2:15-2:35pm: ASU Stefan Myhajlenko
- 2:35-2:55pm: Louisville Jasmin Beharic
- 2:55-3:15pm: Chicago Chrystian Posada Arbelaez
- 3:15-3:25: Stanford Tobi Beetz Closing remarks
- 3:25-3:45pm: Break/Vendor Exhibit
- 3:45-4:30pm: Open Discussions
- 4:30-5:30pm: SNF/ SNSF Tours
- 6:00pm: Dinner with Sponsors Shriram Building Tea Room and Terrace





