Poster Session 3

MGH 241, Easel 153

2:30 PM to 4:00 PM

Applications of Boron Clusters in Liquid Crystal Synthesis

Julian Reed, Senior, Chemistry, Whitman College
Mentor: Mark Juhasz, Chemistry, Whitman College

My presentation reviews existing literature on the use of boron clusters in liquid crystals. Liquid crystalline substances are usually composed of long, thin carbon-based (organic) molecules and have applications in electronic display technology and chromatography. Many compounds with liquid crystalline phases contain rigid substituent groups. The rigidity of inorganic boron clusters and their ability to form linear compounds by attaching groups to atoms on opposite ends of the cluster make them an intriguing starting point for the synthesis of new liquid crystalline materials. Work conducted on the synthesis and properties of boron cluster-based liquid crystals in comparison with organic cyclohexane- or benzene-based analogues is discussed. In addition, new derivatives of a specific boron cluster, CB11shy;H12shy;-, synthesized in our lab using microwave and stardard Schlenk line techniques, are presented, along with an evaluation of their potential as precursors for new liquid crystals. We present a relaible pathway to a new difunctionalized carboxylic acid derivative.

Poster Session 3

MGH 258, Easel 182

2:30 PM to 4:00 PM

Photoresist Reticulation during SiO2 Plasma Etching

Stephanie Tram Sin, Junior, Pre Engineering
Mentor: Michael Khbeis, Washington Nanofabrication Facility
Mentor: Fred Newman
Mentor: Mark Morgan, EE, Washington Nanofabrication Facility

Etching is one of the critical process steps in the fabrication of micro- and nano-scaled devices. Prior to etching, a pattern, usually defined in a temporary photo-sensitive polymer mask material called photoresist, is transferred onto a silicon wafer. One way to etch material, is through the use of plasma. Inductively Coupled Plasma (ICP), is distinct for its coil that shapes plasma and DC bias coupling for directionality. The machine has high etch rates and is used to etch oxide. Specifically for this project ICP-F (Fluorine) has been used. During etching, a photoresist reticulation problem has occurred. With this reticulation, features on the wafer are degraded, when reticulation is wide spread, the whole wafer must be stripped and restarted. This problem affects the speed and quality of production of wafers. In attempts to fix this problem, different variables such as the DC bias, chuck temperature, He backing, and RF power are monitored. Furthermore, the effects of varying pre-etch conditions, such as wafer bakes and different wait times, are examined to determine if there is a correlation between moisture in the photoresist film and resist reticulation or if the issues are predominately related to the etching system. Different inspection steps are made to ensure the quality of the etch, such as visual inspections and measurements of etch depths. These inspection steps concludes how much reticulation has occurred and what it has affected. ICP-F etching is just one step of the process in of fabrication of micrometer scale inductors and capacitors directly on the top of silicon wafers referred to as Integrated Passive Devices (IPD). This process decreases the amount of space used and increases the bandwidth of radio frequency (RF) analog filtering and the speed of digital information transfers.

Poster Session 3

MGH 258, Easel 183

2:30 PM to 4:00 PM

Manipulation of Deep Reactive Ion Etching Process Variables to Achieve Vertical Sidewalls

Andrew Setzer, Senior, Materials Science & Engineering UW Honors Program
Andrew J. Copsey, Senior, Materials Science & Engineering
Mentor: Michael Khbeis, Washington Nanofabrication Facility
Mentor: Mark Morgan, EE, Washington Nanofabrication Facility

Deep Reactive Ion Etching (DRIE) is used for high aspect ratio etches in silicon wafers. The process is effective at achieving deep etches with high anisotropy and selectivity, however more process development is required such that side wall profile angle is selectable based on etch parameters. The

goal of this study is to manipulate process variables (including pressure, etch time, and temperature) to allow the production of tapered, reentrant, or vertical side walls as needed. The SPTS-DRIE will be used to etch silicon targets with a repeating array of test patterns using a standard etch and deposition recipe. The standard etch recipe used will cycle between polymer deposition steps and plasma etching steps at low pressure using C4F8 and SF6 gases. Etch depths will be verified using a Bruker DekTak profilometer and sidewall angles will be measured using a Jeol scanning electron microscope. The parameters of the etch recipe will then be adjusted depending on the previous etch profile. Depending on the profile and aspect ratio of the etch, different parameters will be studied, including the process pressure, temperature, gas flow rates, and etch/deposition times. This process will be repeated until results within a reasonable margin of the target are reached. The goal will be to obtain an etch profile with sidewall angles of 90 ± 0.1 for use in industry and to determine parameters for reentrant and tapered profiles.

POSTER SESSION 3

Balcony, Easel 101

2:30 PM to 4:00 PM

Fabric Form Concrete + DUO System

Ruisheng (Sean) Yang, Senior, Architectural Design
Morocco Mcclay Branting, Junior, Architectural Design
Mentor: Tyler Sprague, Architecture
Mentor: Mark West

Our work is an attempt to revolutionize the building industry by rethinking concrete formwork by eliminating dimensional timber formwork and replacing it with a combination of the existing PERI modular formwork system, fabric, and various constructed inserts. Not only would the customizable secondary systems we have studied are cheap to construct either on site or in a factory alongside PERI modular parts, but they would also be reusable, perhaps indefinitely. In the long run this system could minimize cost on a single job site as well as overall - as the formwork is reusable, highly mobile, flexible, and quick to install. Our system also introduces controlled organic forms, often avoided in concrete due to the difficulty of shaping rigid formwork. By using fabric, complex curvatures can be achieved that are created wholly by setting parameters (fabric excess, insert pieces, etc.) And letting the forces of hydrostatic pressure naturally dictate the ultimate form and aesthetic.