ENGR 240 – Science of Materials

Laboratory Report Grade Sheet

Names: Yifan Ge, Kaixiang You, Ahmed Mahmood

Lab Report Title: Patterning Using Photolithography

Format: (all of the following are worth 1 point per occurrence)

\_\_\_ Report title, group member names, and date appear in that order, centered at top of page

\_\_\_ Page setup: all margins 0.5”, 2 column format for all report text after title and authors

\_\_\_ Text is left & right justified

\_\_\_ All text 10 or 11 pt. font, single spacing

\_\_\_ All table titles and figure captions are 9 - 10 pt. font (one font size smaller than text), bold

\_\_\_ All tables have titles (above)

\_\_\_ All figures have captions (below) and NO TITLES

\_\_\_ Pages are numbered, bottom center

\_\_\_ All sections have appropriate headings (as listed in rubric)

\_\_\_ Headings immediately precede corresponding section (not split bottom/top of next page)

\_\_\_ Significant figures are consistent

\_\_\_ Plots/Tables have error bars/report standard deviation (when appropriate)

\_\_\_ All values have appropriate units

\_\_\_ Non-breaking space used between values and units (hold ctrl-shift-space simultaneously)

\_\_\_ Symbols for units used where appropriate

\_\_\_ No constants in tables (e.g., π or common sample dimension)

\_\_\_ Table column headings contain units

\_\_\_ Table column headings contain common multipliers (exponents, etc.)

\_\_\_ Figure axes are labeled

\_\_\_ Figure axes contain units

\_\_\_ Figure axes contain common multipliers or log scale if appropriate

\_\_\_ Figures have white background

\_\_\_ Each data set in a figure is clearly marked and easily distinguishable

\_\_\_ Table and figures appear intact and are not split at the bottom/top of next page

\_\_\_ Consecutive tables and figures do not contain redundant information

\_\_\_ Limited use of personal pronouns

\_\_\_ Limited use of direct quotes from the textbook

\_\_\_ Experimental values are compared to values reported in the literature (when appropriate)

\_\_\_ Proper use of Appendices

\_\_\_ Style (scale of 1 to 4)

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Content: (each of the following is out of 4 points)

Abstract \_\_\_ x 1 = \_\_\_

Introduction \_\_\_ x 2 = \_\_\_

M&M \_\_\_ x 3 = \_\_\_

Results \_\_\_ x 4 = \_\_\_

Discussion \_\_\_ x 5 = \_\_\_

Conclusions \_\_\_ x 2 = \_\_\_

References \_\_\_ x 1 = \_\_\_

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**LAB 5: Patterning Using Photolithography**

Members: Ahmed Mahmood, Kaixiang You, Yifan Ge

Date: September 28, 2010

**Abstract:-**

In this experiment we learned about Photolithography using a negative tone photo-resist. We found that upon exposure to Ultra-Violet (UV) light, the UV curable adhesive polymerizes and cross-links, thereby displaying the pattern on the photo mask.

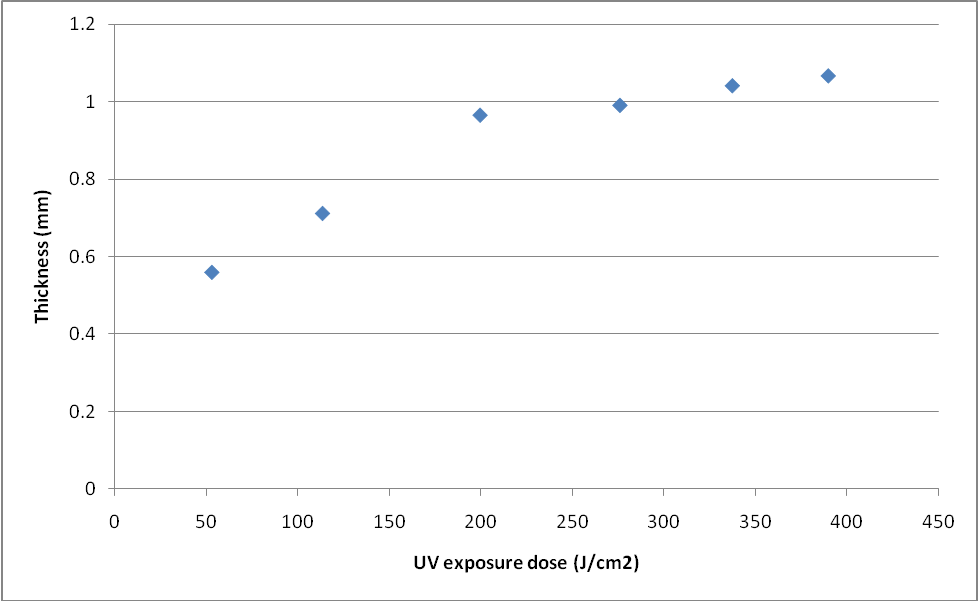
**Introduction:-**

Photolithography is a process by which a specific pattern is transferred onto a substrate. The pattern is on a film, called photo mask. The substance that gets cured is called the photoresist, and in our experiment this was a UV curable adhesive, meaning, it would harden upon exposure to UV light, which is let through the photo mask. We used glass substrate. Substrate is the substance to which the photoresist adheres to, and it was transparent, so as to let the UV light pass through it. The adhesive is UV sensitive meaning it hardens upon exposure to UV light. We experimented with varying intensity of UV light and by increasing the time that the photoresist was left exposed to UV light.

**Materials and Methods:-**

We first turned on the UV light and let it warm up for some time. Three glass slides were then obtained and cleaned with ethanol and acetone. Slides must be clean of any fingerprints as these would disrupt the UV light and affect our pattern on the photoresist. They were then dried and cleaned with Oxygen-Plasma cleaner. The adhesive was NOA-81 and it was put in a cap/gasket until full. Glass slide was placed diagonally so as not to let any air bubbles in it. The photo mask was place on the top side of the slide and the whole setup placed under the UV light. We noted the UV light intensity for each experiment and used different time for exposure. After the pre-determined time, we removed the setup, took the slide off the gasket and cleaned off the excess adhesive, dried and cleaned with acetone/ethanol. Finally, they were left to harden in air.

**Results:-**



**Figure 1. Thickness versus UV exposure dose.**

**Discussion:-**

From the results data, we can clearly discover that the thickness of the pattern increases along with the increment of UV exposure dose. Also, in Figure 1, the slope of thickness vs. UV exposure dose decreases as UV exposure dose increases. Hence, the increment of UV exposure dose will decrease the effectiveness of the polymerization.

**Conclusion:-**

* The thickness of the pattern increases as UV exposure dose increases.
* The effectiveness of polymerization decreases as UV exposure dose increases.

**Appendix:-**

**Table 1. Data collected from Lab.**

|  |  |  |  |
| --- | --- | --- | --- |
| Time (s) | Intensity (mW/cm2) | UV exposure dose (J/cm2) | Thickness (mm) |
| 50 | 1055 | 52.75 | 0.5588 |
| 100 | 1133 | 113.3 | 0.7112 |
| 150 | 1330 | 199.5 | 0.9652 |
| 200 | 1380 | 276 | 0.9906 |
| 250 | 1350 | 337.5 | 1.0414 |
| 300 | 1300 | 390 | 1.0668 |

UV exposure dose (J/cm2) = UV exposure intensity (mW/cm2) UV exposure time (s)

