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Self-aligned DSA of multi-color manufacturing-relevant patterns

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Abstract: **Shrinking feature sizes in next generation devices has accentuated the need for placement precision and alignment between numerous layers. If a self-aligned strategy could be realized it would thermodynamically insure that each layer was in proper contact with its underlying layer. Such a self-aligned strategy would allow and even correct for instrument alignment error. We propose to create a chemical pattern from an existing metal dielectric layer in order to perform self-alignment of block copolymers.**

Introduction

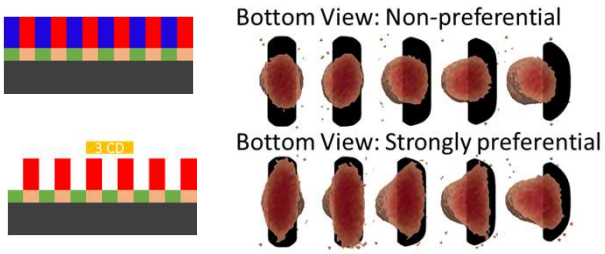
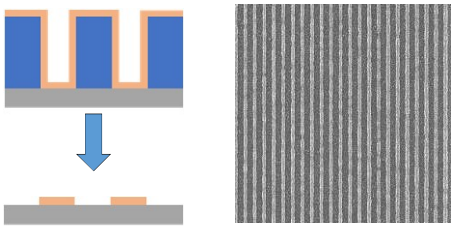


Fig. 1. Placement precision is key for the electrical conductivity of circuits in next generation devices. Lines left and contact holes right both need good overlay precision to achieve electrical connection

Patterning



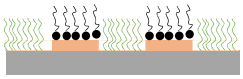
Deposit and Lift Off

Cu/SiO Lines
50 nm CD, 100 nm Pitch

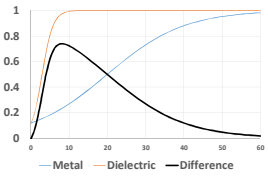
From Metal Pattern

To Chemical Pattern

With Orthogonal Functionalization



Cabrita, J et al, *Corros. Prot. Mater.* 2010
Dai, C. et al, *Soft Matter,* 2014



Or Kinetic Controlled Functionalization

Fig.2 Traditional lift off processes can be used to create arrays of metal lines similar to those found in devices. We then have multiple functionalization options to create a chemical pattern.

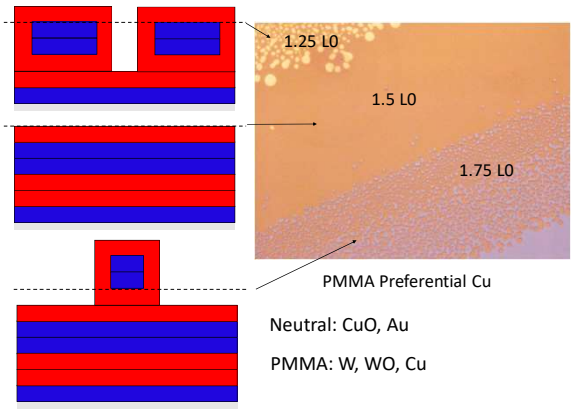


Fig. 4. To identify the chemical preferentiality of a substrate a 'hole-island' test can be performed. Here holes at 1.25 L0 thickness and islands at 1.75 L0 thickness signify asymmetric wetting.

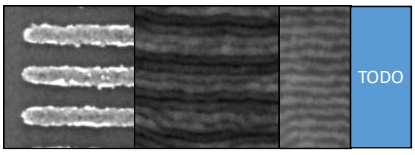


Fig. 5. After identifiying a suitable chemical pattern, we perform 4X DSA which is then converted into an etch mask with Sequential Infiltration Synthesis. Optimization of SIS and pattern transfer is ongoing work.

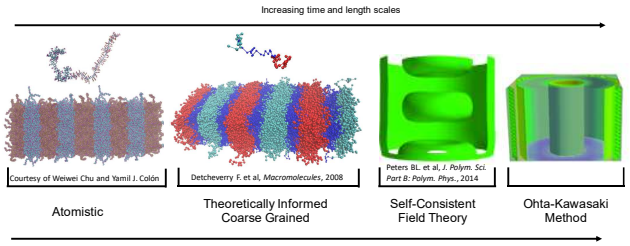


Fig. 6. Many of our experiments are guided by close collaboration with Dr. Juan de Pablo. Shown here is just a few of their simulation results.

Conclusions

We have shown metal dielectric patterns can be utilized as chemical patterns for DSA. Metal and Dielectric patterns posses a unique advantage in that the pattern contains within it a natural hard mask material. Work is ongoing to determine the pattern transfer capabilities of these patterns.

Acknowledgement

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References

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