

Nanoscale Chemical Patterning

P. S. Weiss

*The Pennsylvania State University, Departments of Chemistry and
Physics, University Park, PA 16802-6300*

We exploit our ability to control self- and directed assembly at the sub-nanometer scale in order to create nanoscale chemical patterns, as well as to extend and to enhance soft and hybrid lithographies.^{1,2} The interactions between molecules can be tailored, controlled, and directed. We have designed and assembled new families of molecules for patterning, and have tested the properties that affect their interactions, quality, and controllability. We have prepared molecular monolayers that are labile, so as to enable selective displacement, and have elucidated the mechanistic details of displacement.²⁻⁵ The complex chemical patterns created include isolated molecules placed in high-quality matrices with designed interactions and environments.^{2,6} These can be used to control molecular function, biospecificity and other properties.⁷ Isolating molecules also has significant advantages in preserving patterned nanostructures during further functionalization. We are developing broadly applicable metrology tools for patterning and chemistry at this scale.⁸

¹R. K. Smith, P. A. Lewis and P. S. Weiss, *Progress in Surface Science* **75**, 1 (2004).

²T. J. Mullen, C. Srinivasan, M. J. Shuster, M. W. Horn, A. M. Andrews, and P. S. Weiss, *Journal of Nanoparticle Research* **10**, 1231 (2008).

³A. A. Dameron, J. R. Hampton, R. K. Smith, T. J. Mullen, S. D. Gillmor, and P. S. Weiss, *Nano Letters* **5**, 1834 (2005).

⁴H. M. Saavedra, C. M. Barbu, A. A. Dameron, T. J. Mullen, V. H. Crespi, and P. S. Weiss, *Journal of the American Chemical Society* **129**, 10741 (2007).

⁵H. M. Saavedra, C. M. Thompson, J. N. Hohman, V. H. Crespi, and P. S. Weiss, *Journal of the American Chemical Society* **131** (2009), in press.

⁶P. S. Weiss, *Accounts of Chemical Research* **41**, 1772 (2008).

⁷M. J. Shuster, A. Vaish, M. E. Szapacs, M. E. Anderson, P. S. Weiss, and A. M. Andrews, *Advanced Materials* **20**, 164 (2008).

⁸C. Srinivasan, T. J. Mullen, J. N. Hohman, M. E. Anderson, A. A. Dameron, A. M. Andrews, E. C. Dickey, M. W. Horn, and P. S. Weiss, *ACS Nano* **1**, 191 (2007).