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Combining Etching with Laser Ablation to Form Hierarchical Structures in Silicon, Aluminum, and Titanium ABBIE GANAS, NAHUM ALBA, KURT KOLASINSKI, West Chester Univ — Combining nanoscale with mesoscale features across macroscopic substrates can lead to functional materials. Self-limiting electrochemical etching is well known for making nanostructures.[1] Chemical etching is capable of making geometrically well-defined structures spanning from the nanoscale to the macroscale.[2,3] Both require control over the initiation sites to make hierarchical structures with features ranging over several orders of magnitude. Laser ablation with a nanosecond pulsed Nd:YAG laser produces texture in the form of regular arrays of pillars (with a ≈period of several micrometers) or ripples (with a period ≈wavelength of light). These substrates are etched electrochemically or chemically to produce combinations of properties such as low reflectivity (black Si, black Ti, black Al) with quantum confinement induced visible photoluminescence; or membranes composed of micrometer sized pores, the walls of which contain high surface area nanoporous material. Methods and mechanisms of hierarchical structure formation will be discussed.

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[2]M. E. Dudley and K. W. Kolasinski, J. Electrochem. Soc. **155**, H164-H171 (2008).
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