Reliable multiscale patterning across nanometer to millimeter scale is of great importance but challenging for various applications. In this presentation, I will first share a unique multiscale patterning process called “sketch and peel” lithography. The process is based on electron or ion-beam lithography, but it allows much higher patterning throughput with enhanced resolution for multiscale features compared to conventional processes. The applications of this unique process for transfer printing and flexible & stretchable devices will also be summarized. During the talk, a brief introduction to our work on other extreme micro/nanomanufacturing approaches and relevant applications will also be given.