

ABSTRACT:

This paper reports micro-electro-discharge machining of vertically aligned carbon nanotube forests for the formation of high-aspect-ratio, three-dimensional microstructures in the material. The developed forest machining method is a dry process performed in air, generating high-frequency pulses of electrical discharge to locally machine the nanotubes in order to create target shapes in a forest. With this approach, forest microstructures can be fabricated to have varying shapes along their height, unachievable with conventional pre-patterned chemical vapor deposition growth techniques. The use of the pulses with a minimized discharge energy defined with 35 V and 10 pF in the discharge generation circuit leads to an aspect ratio of 20 with the smallest feature of 5 μm in forests without disordering the vertical orientation of the nanotubes. Micromachining of multilayer geometries as well as arrayed needle-like microstructures with angled surfaces is demonstrated.