

Plasma Enhanced Chemical Vapor Deposition (PECVD) Synthesis of a Carbon-Based Nanotechnology Catalyst entitled Carbon Nano Spikes (CNS)

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The arrangement of active sites on a nanostructured catalyst can yield new ways to influence complex reaction mechanisms. This work describes the synthesis of a novel textured carbon comprised of 50-80nm Carbon Nano Spikes (CNS) with a ~5% nitrogen dopant which is highly active for electrochemical catalysis. When co-doped with ~50nm copper nanoparticles, the ¹CNS electrocatalyst converts CO₂ to ethanol with high Faradaic efficiency or yield (63% at -1.2V vs reversible hydrogen electrode (RHE)) and high selectivity (84%) in aqueous bicarbonate and at ambient temperature and pressure. The CNS can be coated onto a variety of ²materials. ³Challenges regarding the process and patterning will also be described.

References:

¹High-Selectivity Electrochemical Conversion of CO₂ to Ethanol using a Copper Nanoparticle/N-Doped Graphene Electrode, Yang Song, Rui Peng, Dale K Hensley, Peter V Bonnesen, Liangbo Liang, Zili Wu, Harry M Meyer, Miaofang Chi, Cheng Ma, Bobby G Sumpter, Adam J Rondinone, Publication date 2016/11/16, Journal Chemistry Select, Volume1, Issue 19, Pages 6054-6061

²Carbon nanospikes grown on metal wires as microelectrode sensors for dopamine, Alexander G Zestos, Cheng Yang, Christopher B Jacobs, Dale Hensley, B Jill Venton, Publication date 2015, Journal Analyst, Volume 140, Issue 21, Pages 7283-7292

³Growth and electrochemical characterization of carbon nanospike thin film electrodes, Leah B Sheridan, Dale K Hensley, Nikolay V Lavrik, Sean C Smith, Viviane Schwartz, Chengdu Liang, Zili Wu, Harry M Meyer, Adam J Rondinone, Publication date 2014/1/1, Journal of The Electrochemical Society, Volume 161, Issue 9, Pages H558-H563

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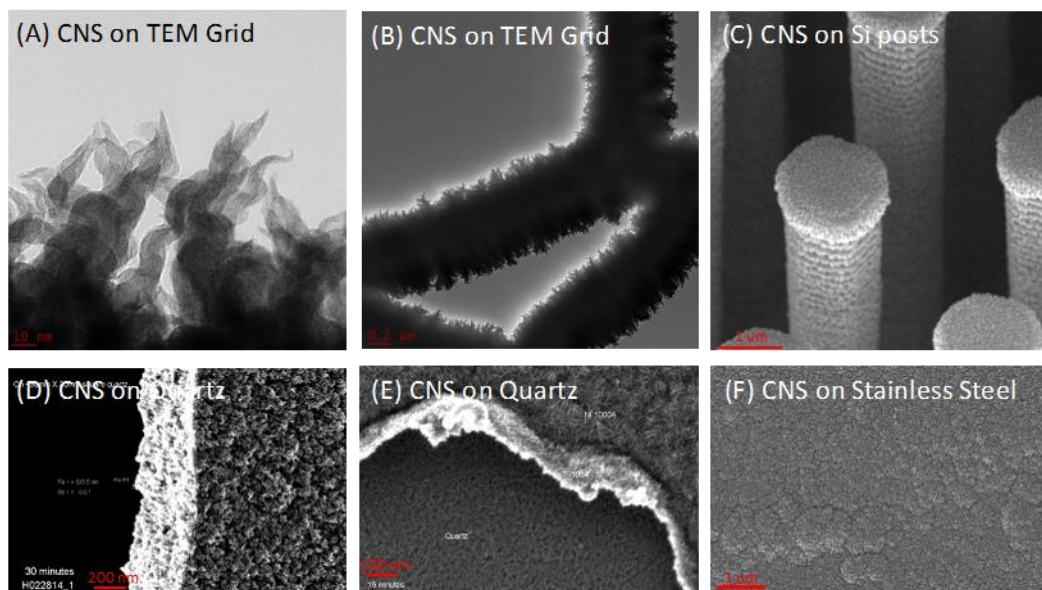


Figure 1. Carbon Nano Spikes have been grown on a variety of substrates including (A&B) TEM Grids, (C) etched silicon posts, (D&E) quartz, and (F) stainless steel.