CHYN MEETS HARBOR

Synthesis of hierarchical porous monolithic silicon and amorphous silica by means of silver catalyzed chemical etching

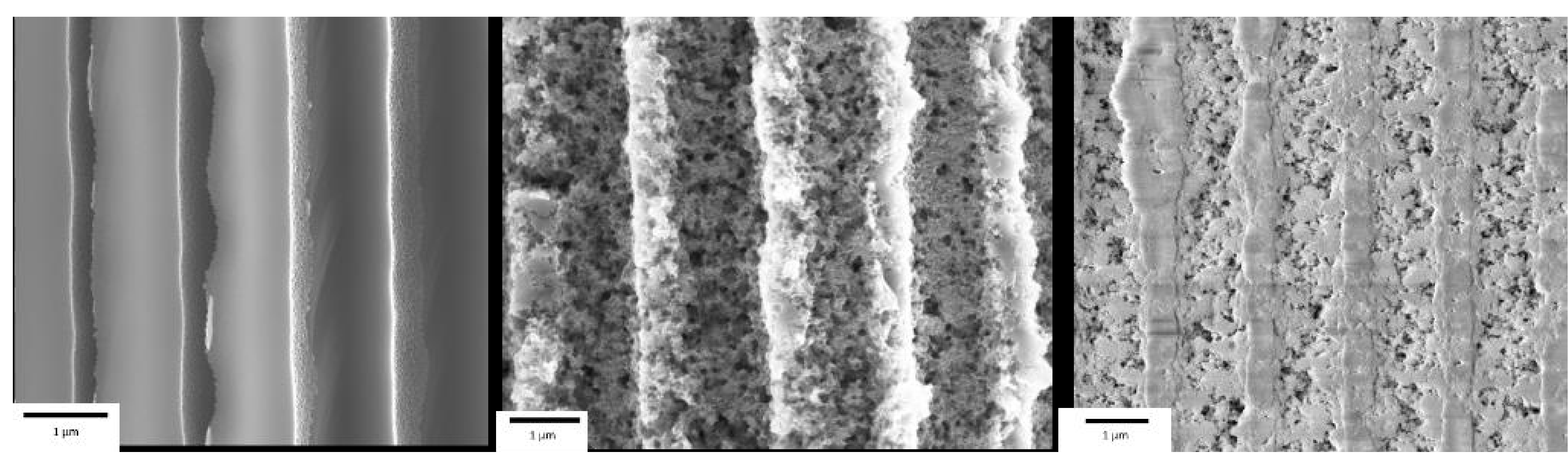
Stella Gries

Catalyst-assisted growth and characterization of ZnO field emitters on nanomembranes

Stefanie Haugg

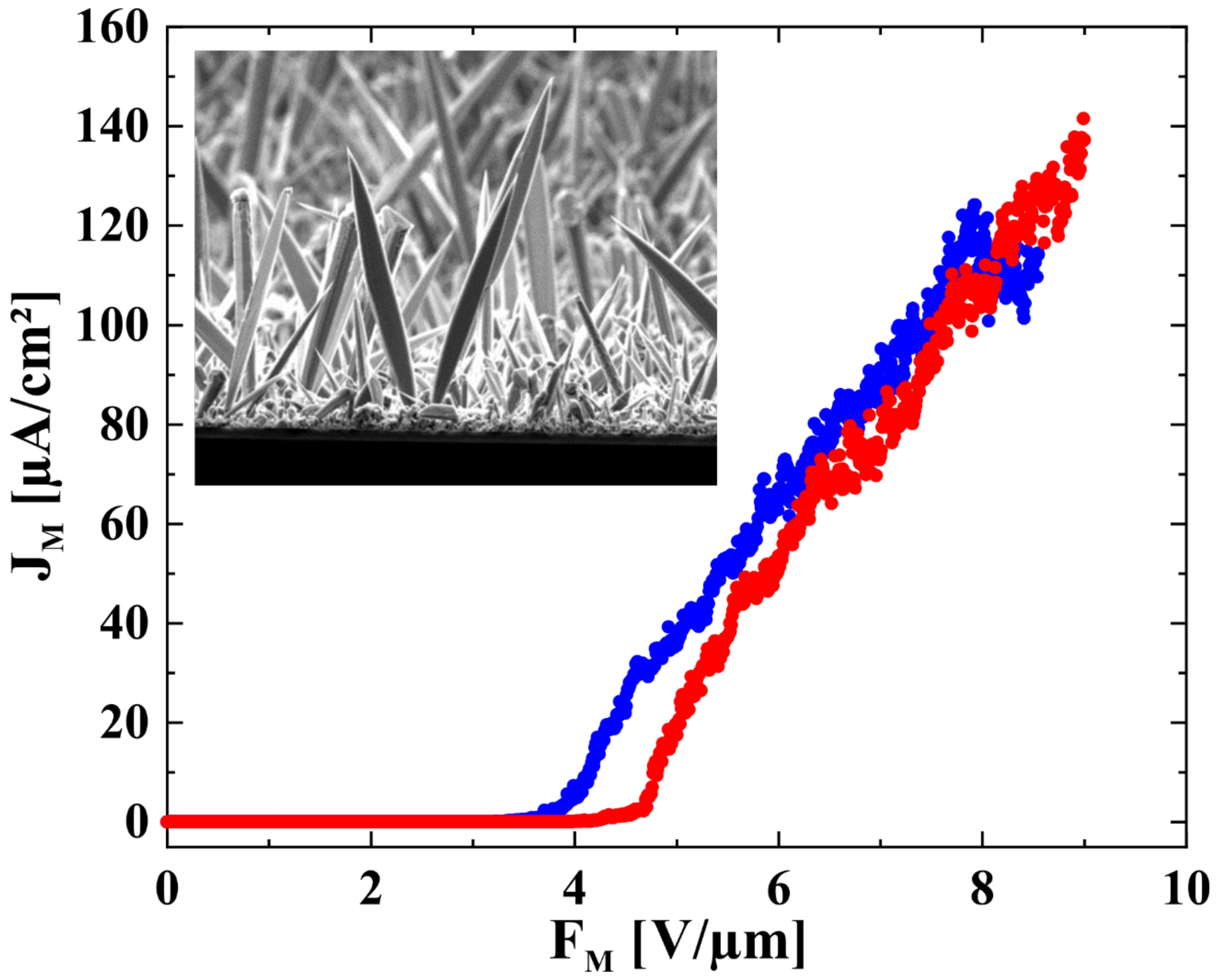
Abstract Talk 1: Porous silicon (pSi) offers a wide range of applications in modern materials development. Adapting silicon structures to their specific fields of application is a challenge for many researchers. Many methods for structuring have already been developed and also tested in industrial applications, so top-down methods such as electrochemical etching are state of the art in the processing of silicon. A process that has received less attention so far is metal-assisted chemical etching (MACE). Using metal particles or films and a solution of hydrofluoric acid (HF) and an oxidizing agent, silicon structures can be etched comparatively cost-effectively and simply. This method is mainly used for the synthesis of silicon nanowires (SiNW) and pores, with the main focus on stationary deposited films for the synthesis of highly ordered SiNW. This presentation deals with a new approach in metal-induced etching. By adjusting a silver particle and oxidizing agent concentration macroporous silicon membranes can be further porosified on wafer scale into hierarchical porous silicon.

The aim is to achieve a structure that offers good flow dynamics and an easier imbibition with matter and simultaneously having large surfaces for interactions like for anode materials in energy harvesting or conversion or for sensor membranes. Hierarchical porous amorphous silica (hp-SiO_2) can be obtained from the same material, by using the circumstance that pSi sinters at temperatures above 400°C.



Abstract Talk 2: Field emission (FE) cathodes exhibit some remarkable properties compared to conventional thermionic electron sources. They naturally offer a larger emission current density and no external heating device is required to sustain the quantum mechanical emission process. Combined with the exponential dependence of the emission current on the applied electric field, field emitters are attractive electron sources for a number of applications, such as flat display screens, X-ray tubes and ionizers in mass spectrometers.

When the FE cathode is positioned on a flexible base, it may also be used as a highly sensitive displacement sensor. However, the available types of flexible substrates for field emitters are severely limited. Often, polymeric substrates or carbon fabrics are used, which impedes the direct growth of emitters because of the substrate's temperature instability or its incompatibility with the growth process. Herein, a method is presented that allows for the catalyst-assisted CVD growth of ZnO nanowires directly on free-standing inorganic nanomembranes. On the one hand, the morphology of the ZnO emitters on the flexible substrates was examined to identify possible growth mechanisms and on the other hand, their FE characteristics were investigated. The low turn-on field for FE together with the observed stability of the emission current over several hours suggest their future application in FE-based sensors.



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