Growth and characterization of nanoporous thin films using molecular beam techniques

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Vapor deposition from a collimated source can be used to control the nanometer scale morphology of materials. Systematic variation of the incident angle during the deposition allows the growth of non-porous to highly porous films as the deposition angle increases from normal to glancing. The deposition angle dependent film morphology can be understood using a simple physical concept of shadowing and limited surface mobility. This method of producing films is referred to as ballistic deposition. The extremely high surface area (up to 3000 m^2/g) of films deposited at glancing angles makes the ballistic deposition technique attractive for the preparation of catalytically important materials. The film morphology, reagent transport kinetics, and catalytic activity of nanoporous films of amorphous solid water (ASW), MgO, WO_3, Pd, and TiO_2 grown via ballistic deposition will be discussed.

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