NANOPOROUS ANODIZED ALUMINA (Al₂O₃) AS A TEMPLATE FOR NANOTECHNOLOGY

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High purity aluminum has been shown to grow interesting alumina (Al₂O₃) thin films when anodized.[1] Alumina films fabricated in this way show holes, often ordered arrays of holes. We have fabricated alumina nanopores with hole diameters ranging from 7 nm to 40 nm. The 40 nm nanopore arrays exhibit hexagonally ordered pores. The pores go through the entire thickness of the film, perpendicular to the surface of the Al, and do not break into each other even for alumina films as thick as 500 μ. The pores are dense packed; for 40 nm pore diameter the pore-pore distance is app. 90 nm. This is possible with careful surface preparation of the Al, and control of anodization conditions. With .3 M Oxalic Acid we find a pore diameter of 50 nm, and hexagonal ordering with an average distance between imperfections of 1-2μ.

Since alumina is a very strong, heat resistant material, these films provide a novel template with diverse uses. We have used these films as a lithography mask in UV/X-Ray exposure. This is part of a plan to use lithography and chemical etching as a way to make porous silver films. Silver films with a minimum pore diameter of 150 nm, have shown extraordinary optical transmission properties. [2] We hope to observe similar phenomena and develop potential applications of such films. Other current efforts are to make nanowire arrays using an evaporative deposition process to fill the Alumina nanopores. Bismuth, an established system being studied, and Chromium are two materials that we will report our progress on. The small diameters of the pores and the relative (controllable) thickness of the films mean we have large aspect ratios, 2000 for a 100 μm thick film and 50 nm diameter pore, making them true nanowires.

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