THE EFFECTS OF SURFACE FUNCTIONALIZATION AND TEMPERATURE IN AFM LITHOGRAPHY ON SILICON

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The thickness of the water layer on the silicon surface is an important factor of AFM anodic oxidation lithography. After appropriate surface functionalization, the water layer thickness is expected to be changed due to the change of the hydrophilicity of the surface. Our experiments show that the AFM tip-induced oxide height and width are affected by such surface functionalization treatments with APS (3-aminopropyl triethoxysilane) and OTS (octadecyltrichlorosilane). As the surface is more hydrophilic, the oxide is higher and wider, as shown in Fig. 1. On the other hand, the oxidation mechanism is also influenced strongly by surface temperature. While the temperature may affect both the dissociated ion diffusion rate and the water layer thickness, the volume of the oxide is found to decrease with the increasing temperature, as shown in Fig. 2.

Figures:

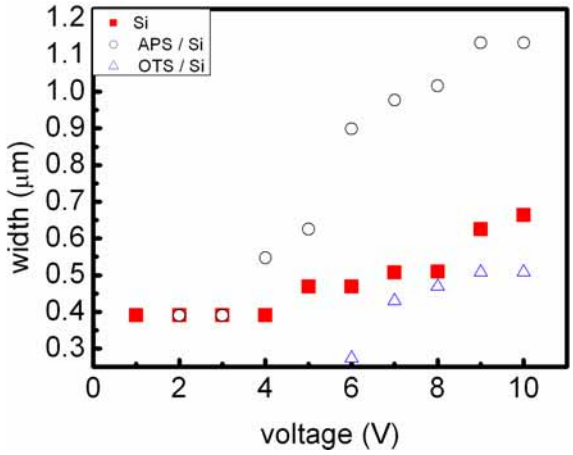

Figure 1: The width of the tip-induced oxidation vs. the applied voltage of the AFM tip under different surface functionalizations.

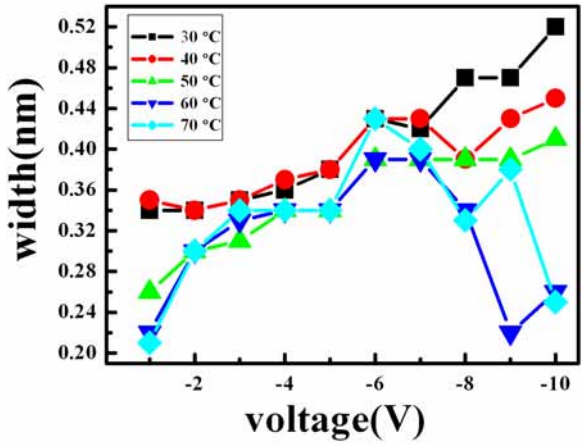

Figure 2: The width of the tip-induced oxidation vs. the applied voltage of the AFM tip under different surface temperatures.