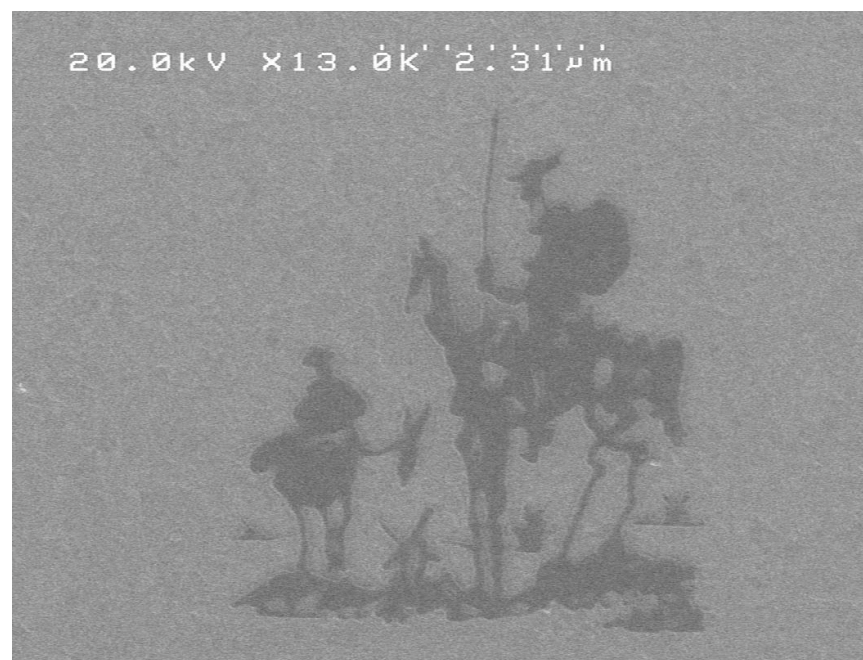


Size Dependence of Phase Transitions in Nanocrystalline Oxides

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Vanadium dioxide (VO_2), a semiconductor at room temperature, changes crystal structure and becomes metallic at 70°C . The effects of this change — a huge increase in electrical conductivity and optical reflectivity — are even more pronounced in nanocrystals than in thin films. However, fabricating oxide nanocrystals is challenging because it is so difficult to achieve high purity. And if the nanocrystals are not pure VO_2 , their desirable properties vanish. To make nanoscale photonic or electronic devices of VO_2 and similar oxides, we have developed a robust synthetic process that combines focused ion-beam lithography and laser vaporization to create nanoscale patterned metal oxides. These could be used as building blocks for ultrafast optical switches or transistors. To show the capability of this new process, we have taken some artistic license with Picasso.



Scanning electron micrograph of Picasso's pen-and-ink sketch of "Don Quixote" in VO_2 (dark color) on an indium-tin-oxide waveguide. The smallest feature size (Don Quixote's spear) is less than 50 nm across.