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Synthesis and characterization of nanocomposites formed by metallic nanoparticles in insulating matrix

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Nanocomposites formed by metal nanoparticles embedded in an insulating matrix have some interesting electrical characteristics. Materials of this kind are of interest from a fundamental perspective as well as for applications. We investigated nanocomposites of Au/PMMA (polymethylmethacrylate), Pt/PMMA, Ti/alumina and Au/alumina systems. In all cases the nanocomposite was produced through metallic ion implantation in insulating substrate, where the implanted metal self-assembles into nanoparticles. Transmission electron microscopy of the implanted samples was used for direct visualization of the nanoparticles formed. The nanocomposites were characterized *in situ* by measuring the resistivity as the implantation proceeded. The surface resistivity measurements were compared with the predictions of a model based on percolation theory, in which electron transport through the composite is explained by conduction through a random resistor network formed by the metallic nanoparticles. Excellent agreement was found between the experimental results and the predictions of the theory. It was possible to conclude that the conductivity process is due only to percolation and that the contribution from tunneling conduction is negligible. Computer simulation using the TRIDYN computer code was used to estimate the depth profiles of the metallic ion implanted in the insulating substrate. This is a Monte Carlo simulation program based on the TRIM (Transport and Range of Ions in Matter) code that takes into account compositional changes in the substrate due to two factors: previously implanted dopant atoms, and sputtering of the substrate surface.

Biography

Maria Cecília Salvadori is an Associate Professor in the Institute of Physics, University of Sao Paulo (USP). She received her Ph.D. in Materials Science from USP and conducted post-doctoral studies at Lawrence Berkeley Laboratory. At this moment, she is the group leader of the Thin Films Laboratory in the Institute of Physics of USP. The main research interests are surface modification, including ion implantation, nano/microfabrication and plasma treatment; thin film deposition using plasma; surface characterization by scanning probe microscopy. She has over 90 publications in reputed journals, 8 Ph.D. concluded supervisions and collaborates with various groups worldwide.

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