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NEW MATERIALS FOR HIGH-CONDUCTIVITY NARROW INTERCONNECTS

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Abstract:
A major challenge for the continued downscaling of integrated circuits is the resistivity increase of Cu interconnect lines with decreasing dimensions, limiting power efficiency and causing the interconnect delay to exceed the gate delay. This resistivity increase is due to electron scattering at Cu surfaces and grain boundaries and leads to, for example, a 10-fold resistance increase for 10-nm-wide Cu lines. Alternative interconnect materials have the potential to outperform Cu. These include metals with a small electron mean free path to render electron scattering at surfaces and grain boundaries negligible, electropositive metals with spherical Fermi surfaces which minimize surface charge transfer and maximize electron transmission at grain boundaries, anisotropic compounds with preferential transport along the wire direction, and 2D and topological metals.
This talk summarizes classical models that describe conduction in nanoscale wires, discusses different approaches to search for conductive materials that may replace current interconnect metals, and provides a summary of experimental and computational research addressing the interconnect resistivity challenge.

Bio:
Daniel Gall is the Robert W. Hunt Professor of Materials Science at the Rensselaer Polytechnic Institute, USA. He received his Diploma from the University of Basel in 1994 and his Ph.D. from the University of Illinois at Urbana-Champaign in 2000. Prof. Gall's research focuses on the development of an atomistic understanding of thin film growth and on the electronic and optical properties of materials, with a particular interest in electron transport in metals at the nanoscale. Daniel Gall has served as Assistant Editor and Editorial Board Member for Thin Solid Films and the Journal of Vacuum Science and Technology A, and as Program Chair for the AVS International Symposium. He is a Fellow of the American Vacuum Society and has won numerous awards from NSF, DoE, RPI, ASM, AVS, IBM, and LAM for his work on transition metal nitrides and on high-conductivity interconnects. Professor Gall has authored over 190 peer-reviewed journal articles. His students won over 60 best poster and paper awards. http://www.rpi.edu/~galld

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