Departamento de Física de la Materia Condensada

Universidad Zaragoza

SEMINARIOS 2024

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Electromigration, from pain to gain

Electromigration is the displacement of ions in a metal resulting from the momentum transfer between conducting electrons and diffusing atoms. Although already investigated more than 100 years ago, it became a major problem only when the severe conditions necessary for operation of integrated circuits (IC) made it apparent in the late 1960s. Although it remains a major concern the negative perception of electromigration has progressively changed during the last decades. Nowadays, controlled electromigration can be regarded as a very promising tool for modifying the physical properties of micro and nanoscale materials with single atom resolution and with a high degree of flexibility. In this lecture, I will present a comprehensive overview of the evolution of electromigration from a device failure mechanism to a nanofabrication tool.

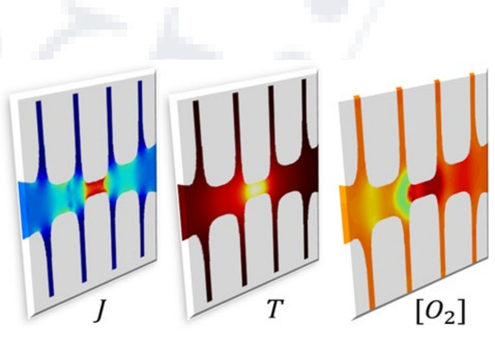

***Figure**: High current density in a narrow constriction produces local heating which in turn thermally activates the directional displacement of oxygen atoms.*

I will briefly discuss the physical mechanisms and some material aspects, propose a method to efficiently and safely control its rate, and finish with some recent applications to the study of superconducting circuitry. The proposed postprocessing technique of controlled electromigration is particularly appealing in view of its simplicity, robustness and applicability to a large diversity of materials.

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