

Séminaire SOLEIL

Physical characterization challenges for advanced microelectronic devices

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Invité par Jean-Pascal RUEFF

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Séminaires

In the last years, the number of materials considered for current or future use in advanced semiconductor-based microelectronic devices has literally soared. Historically, microelectronics was centred on the Si/SiO₂ materials combination, which has enabled several decades of ever smaller devices with ever faster speed. However, further scaling of microelectronic devices has become impossible without the introduction of alternative materials. Experimental semiconductor devices now contain materials such as high- κ oxides (HfO₂, ZrO₂, rare earth oxides, Al₂O₃, Ba- and Sr-based oxides in memory devices, ...) and metal electrodes (TiN, TaN, TaC, W, Ru, ...). Also new semiconductor materials such as Ge, GaAs, or InGaAs are considered. Interconnects are now based on Cu with low- κ dielectrics.

Typically, such semiconductor devices contain a stack of several thin layers with thicknesses of often only a few nm or less. During device processing, the structures can be exposed to high temperatures. Many considered stacks are not thermally stable and the different layers tend to interdiffuse or react with each other. Also, other effects such as phase separation has been observed occur for metastable systems.

Since the final performance of the microelectronic devices will depend critically on its structure on a nanoscale, the understanding of the physical structure of the devices is very important. Because of the small volume of the layers involved, physical characterization has become increasingly challenging with the ultimate goal of obtaining full information about elemental composition, chemical binding, crystallographic and vibronic structure, as well as the thermal behaviour of the structures with sub-nm resolution.

In this presentation, the behaviour of a number of example stacks upon thermal annealing is presented. Different characterization methods are compared and the potential of synchrotron methods for the characterization of advanced microelectronic devices is discussed.

Formalités d'entrée : accès libre dans l'amphi du Pavillon d'Accueil. Si la manifestation a lieu dans le Grand Amphi SOLEIL du Bâtiment Central, merci de vous munir d'une pièce d'identité (à échanger à l'accueil contre un badge d'accès).

SYNCHROTRON SOLEIL

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