

RECENT DEVELOPMENTS OF IN SITU HREM FOR MATERIAL REACTIONS

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The development of in situ high resolution electron microscopy, from a means to directly observe reactions at the atomic scale in materials to being a real quantitative tool, is now well-documented. In this paper, we describe recent applications of this approach, particularly for investigating the behavior of possible materials for future silicon-based transistors. The kinetics and mechanism of crystallization in a candidate high-k dielectric metal oxide will be documented and the extension to use the FIB-TEM combination in order to probe the electrical properties of individual crystals is established. Reactions in possible future gate metals will be shown, particularly the formation of NiSi and the consequences of the breakdown of the thin SiO₂ gate oxide.