Emerging EHS/Research Needs
ERC Review 2011

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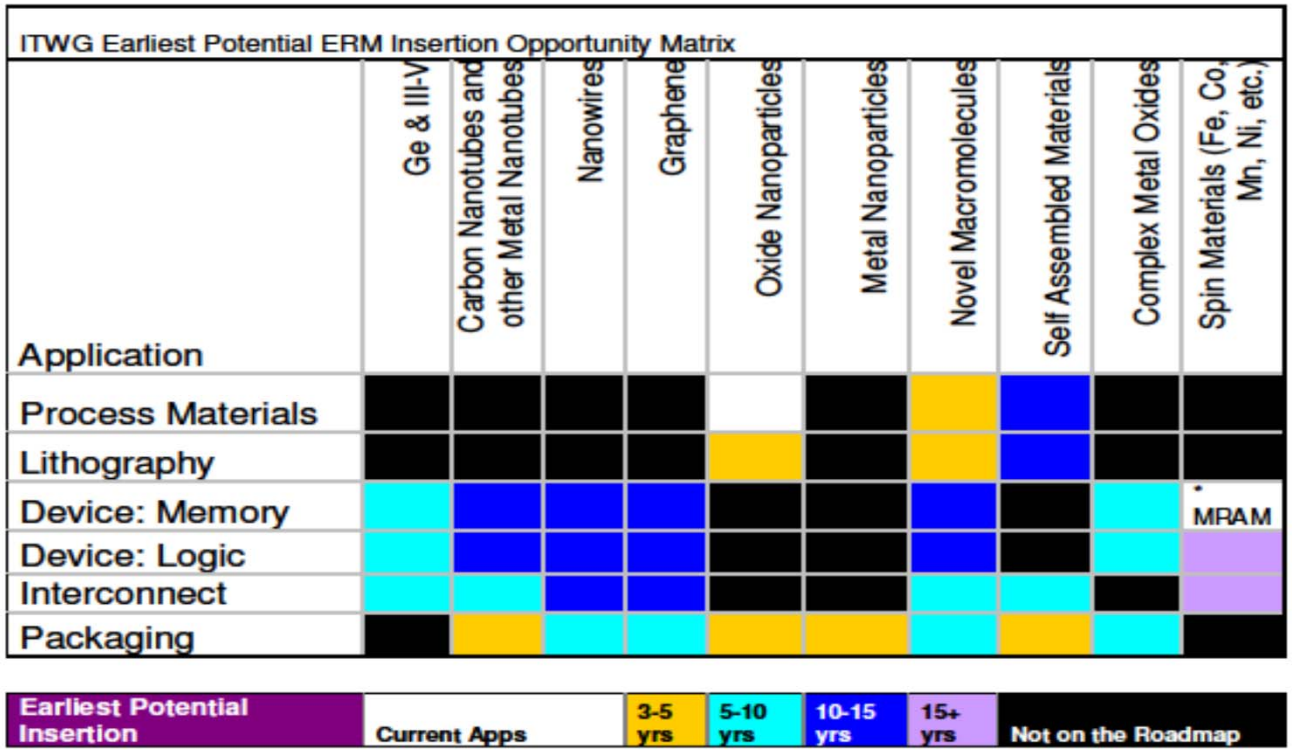
Research Needs for Emerging Technologies

- Proactive assessment of EHS aspects of nano-scale electronics manufacturing are an important technical and policy concern
- There is a need for better forecasting concerning which novel materials and “nano” manufacturing techniques (materials and processes) are most relevant for future High-Volume Manufacturing
- EHS concerns related to emerging technologies are described in the ITRS (ESH and Emerging Research Materials chapters)
- It remains unclear which technologies and manufacturing methods that are most relevant for near-term and future manufacturing (5-15+ yrs)
- Screening methods are needed to identify which EHS assessment needs (such as toxicological evaluation, workplace engineering controls, environmental fate and transfer studies, etc.) should be prioritized

ITRS Emerging Research Materials (ERM)
{ESH Text for Technology Insertion Point Table}

- To support the ESH Technology Work Group (TWG) and the research community in identifying when new materials are becoming more viable, the “earliest potential insertion timing table” has been developed in collaboration with the other technology work groups.
- Earliest potential time varies greatly depending on the application with potential applications in 3-5 years for carbon and metal nanotubes, oxide nanoparticles, macromolecules, and self-assembled materials.
- Assembly and Packaging has potential applications for carbon and metal nanotubes in this timeframe in embedded applications. Oxide nanoparticles may have application as novel photoresist additives in Lithography, and as a package polymer additive in Assembly and Packaging.
- Novel macromolecules have potential for application in process chemicals and photoresist in Lithography. Self-assembled materials could also be used in embedded package applications.

Emerging Research Materials: Earliest Potential Technology Insertion Point Table



These are viewed as the potential earliest insertion times for ERM. The ERM12-ESH table will be updated in future ERM Roadmaps.

Research Needs: DFE/LCA Tools

"While the practical value of conducting full Life Cycle Analysis (LCA) is uncertain, industry recognizes the need to consider life-cycle impacts of energy and water use, material consumption, and waste products associated with semiconductor manufacturing. However, robust databases that are readily applicable to leading-edge semiconductor manufacturing are not currently available… ***there is a clear need for better decision-making tools that support integrating ESH criteria into process development, tool and facility design***."

- By definition, Yield Improvement also improves resource efficiency. Yield Improvement coupled with resource reduction drives sustainable High-Volume Manufacturing.
- Industry needs tools that enable forecasting the resulting benefits in High-Volume Manufacturing from improvements made in R&D stages
- When coupled with a strategic focus on Yield Improvement and Performance Enablement, resource efficiency measures can avoid a "Process Risk" stigma that decreases the likelihood of adoption in HVM