PHOTORESISTS FOR EUVL (13.5 nm) WAVELENGTH NANOPATTERNING FROM N7 DOWN TO N3 NODES & BEYOND: MATERIALS CHEMISTRY DESIGN PRINCIPLES FOR HiTECH IC FAB

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Convergent as well as divergent materials design and chemistries will be discussed for preparing various photoresist formulations from polymeric CARs to non-CARs as well as organometallics, and organic-inorganic hybrids to meet the stringent requirements for EUVL. These synthesis goals are essential to meet the rigorous challenges of the all encompassing RLS of advanced EUV IC Fab. Extensive materials characterizations of these resists pre-exposure, are critical and will be discussed along with a reference to photodynamic mechanistic insights. Discussion will also include an introduction to the workhorse of advanced lithography, the Chemically Amplified Resist (CAR) and the central role of Photoacid Generators (PAGs). Their shortcomings and non chemically amplified alternatives.
Since EUV photons are still scarce, protocols based on readily available ebl, HIM tools and FESEM/AFM for metrology have been developed in-house for prescreening the resists for sensitivity, CD, LER/LWR. Patterns with half pitch down to sub 12 nm have been obtained as well as isolated lines of the order of 7 nm. Complex patterns will also be presented. EUV patterned exposures will be presented and prescreened prototypes identified for calibrating resists as potential for EUV fab.
The state-of-the-art clean synthesis labs, materials characterization facilities at AMRC, class 100 clean room at C4DFED with all relevant major tools ebl, HIM, FESEM, AFM, etch are available onsite. International collaborations are essential for successfully meeting the complexities of this advanced technology.

Kenneth E. Gonsalves is Visiting Distinguished Professor at IIT Mandi since Jan 2012 to the present. Prior to that he was the Celanese Acetate Distinguished Professor of Polymer Science at UNC Charlotte, North Carolina USA (2001-2011).

Prof Gonsalves obtained his PhD from University of Massachusetts at Amherst (1984) followed by a Celanese Postdoctoral position at MIT (1984-85). He has been a visiting scientist at Harvard in Prof Whitesides Group (1996). Dr Gonsalves has also been on the faculty of the Dept of Chemistry and Chemical Engineering at Stevens Inst of Technology NJ (1986-90) and the Dept of Chemistry and Polymer Program Inst of Materials Science UCONN (1990-2001). He also served as Associate Director S&T oversight for Americas, Office of Naval Research Global (ONRG) from 2009

to 2011. He is the author and or editor of over 300 publications, several books and numerous patents primarily in photoresist technology. His projects have been funded by NSF, DARPA, DoD, ACS, NCBC and several industry related to photoresist technology, SEMATECH, Intel/SRC, Rohm and Haas/Du Pont amongst others. Projects for advanced photoresists have also been funded by DST, MHRD as well as industry in India. His interests, besides nanoscale resists for NGL, include nanoscale drug delivery focusing on antibiotics, tissue engineering at the nanomicro- scale and organometallic precursors for ceramics. IP and scaleup of advanced photoresist formulations are under active consideration as part of the TSDP DST commercialization initiatives in linkage with industry.