VICTORY Process

Release Notes

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RELEASE NOTES

VERSION 3.11.3

NEW FEATURES

- Parameter ATHENAMASKMODE added to OPTION statement

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where oxidation material properties could not be reloaded properly with simulation status
- Resolve an issue in analytical ion implantation when running in multi-core mode
- Resolve an issue with default minimum cluster concentration in implantation module
- Resolve an issue with convergence of diffusion module in the presence of nitride
- Reduce memory fragmentation in diffusion module
- Remove test functions for obsolete models from open etching deposition model library

VERSION 3.11.2

NEW FEATURES

- 1D mode of EXPORT statement also exports net doping, total donor concentration and total acceptor concentration

ALTERATIONS AND ENHANCEMENTS

- Secondary flux is no longer unphysical high for very special geometrical configurations
- Re-deposition flux is no longer unphysical high for very special geometrical configurations
- Merge consecutive material layers within the multi-layer representation in the initial stage of an oxidation process step
- Take HCl percentage into account when partial pressure of oxidant gas is calculated for mixed ambient oxidation

- Update parameters of the EXPORT statement :
  - BASEFACTORREL – no longer supported
  - INTERFACEREFINEREL – no longer supported
  - BASEFACTORABS – renamed to BASEFACTOR
  - INTERFACEREFINEABS – renamed to INTERFACEREFINE

VERSION 3.11.1

ALTERATIONS AND ENHANCEMENTS

- Improve accuracy estimation in secondary flux calculation engine of physical etching / deposition module
- Resolve an issue in vertical thickness extraction

VERSION 3.11.0

ALTERATIONS AND ENHANCEMENTS

- Improve accuracy of flow solver of oxidation module for some special applications
- Modifying Deal/Grove parameters for poly-silicon even when poly-silicon is not present in the structure is no longer necessary

VERSION 3.9.1

NEW FEATURES

- EXTRACT statement also extracts the thickness of a material in X- and Y- direction and not only in Z-direction

VERSION 3.9.0

NEW FEATURES

- Merge all plasma etching specific statements with equivalent statements of the standard physical etching and deposition module
- Add parameter CONCENTRATION to FLUX statement to support multi-particle etching / deposition models
- Add parameter SPECIES to FLUX statement to support multi-particle etching / deposition models
- Add parameter SPECIES to ETCHDEPOPROPERTY statement to support multi-particle etching / deposition models
- Fully support plasma etching in uncoupled multi-particle mode of the physical etching / deposition module
- Take symmetrical patches into account to calculate the secondary flux coming from outside of simulation domain
- Multi-thread secondary flux calculation
- Enable surface curvature as a dependency for surface reaction models of the open etching/deposition model library
- Add special surface reaction model for silicon crystal etching to the open etching/deposition model library
- Add four species surface reaction model for :
    - ionized physical vapor deposition
    - high power magnetron deposition

  to the open etching / deposition model library
- Add special preconditioner to the viscous flow equation solver of the oxidation module
- Add two species surface reaction model for ion enhanced chemical etching to the open etching / deposition model library

ALTERATIONS AND ENHANCEMENTS

- Parameter SECSOURCE of the ETCH statement is no longer supported
- Parameter SECSOURCE of the DEPOSIT statement is no longer supported
- Parameter SECSOURCE of the IONMILL statement is no longer supported

- Use nearly a constant time step size throughout a single etching or deposition process step
- Modify interaction between the sticking efficiency and the rate in the physical etching / deposition module. The rate is independent on the sticking efficiency.
- Take finest available meshes into account to obtain the corners during flux visibility calculation
- Temporarily deactivate the deck statements

    INIT infile = ...

  and

    STRUCT outfile = ...

VERSION 3.7.0

NEW FEATURES

- Enable setting of substrate temperature for the Monte-Carlo mode of ion implantation

ALTERATIONS AND ENHANCEMENTS

- Resolve a problem in the time integration of the diffusion module

VERSION 3.5.0

NEW FEATURES

- Add material InSb to the open material database
- Add parameters IGNOREVOLUMEDATA, IGNOREMANUALREF, IGNOREPROPERTIES to the LOAD statement
- Add possibility of specifying different etch rates for different crystal planes
- Add support for circles and ellipses in the SPECIFYMASKPOLY statement

ALTERATIONS AND ENHANCEMENTS

- No more artifacts when corner rounding is used in combination with tilted mask sidewalls
- Manual (geometrical) refinement queue is fully re-entrant
- Set ID of interstitial traps to 12 in the open material database

- Material database is re-initialized by means of the LOAD and INIT statements
- Create new folder and files in etching deposition model folder. The new folder is

  'flux'

  The new files are :

  'primaryFundamentals.c'

  'primaryionmilling.c'

  'primaryionbeamdeposition.c'

- Add two fundamental primary flux functions to the open etching deposition model library, they replace the following functions :
  - plasmaEtchIons → cosinepower
  - plasmaEtchNeutrals → cosinepower (with cosine_exp=1)
  - plasmaEtchIonsErfc → errorfunction
- Add Cu as an alias for copper in the open material database
- Add material AlN to the open material database

VERSION 3.3.0

NEW FEATURES

- Introduced 'simulation mode' considering dimensional symmetry
- Add statement SIMULATIONMODE
- Add single-pair-interstitial-supersaturation model to the open diffusion model library
- Add 'hardlink' attribute to the material database
- Add version check for the etching / deposition model folder

ALTERATIONS AND ENHANCEMENTS

- Doping profile obtained by the analytical ion implantation is no longer unphysical low when a 2D like thin slice is simulated with thickness of the slice being less than the lateral range of the implantation point response

- Rename 'three-stream' model to 'single-pair' model
- Apply surface recombination boundary condition for point defects at silicon-gas interfaces
- Change initial point defect concentration to the intrinsic equilibrium concentration
- Avoid setting interstitial concentration to zero, if in the IMPLANT statement the plus.one model is activated and the parameter DAM.FACT is set to DAM.FACT=0
- The parameters MIN.CLUST and MAX.CLUST refer to the doping profile and not to the cluster profile
- Reaction terms are all handled properly at domain boundary points
- Replace all nodelinks in the diffusion modeling data in the open material database with hardlinks

VERSION 3.1.0

NEW FEATURES

- Establish tighter coupling between the oxidation module and the dopant annealing module. In this 'tight-coupled' mode the thermal budget is applied to the dopants before and after each oxidation time step.
- The material parameters for dopant annealing are set by means of the input deck statements MATERIAL and INTERFACE
- Add a module for plasma etching
- Add capability to simulate doping mediated oxidation
- Add capability to simulate orientation dependent oxidation
- Extend the ion milling module by asymmetric re-emission functions for redeposition
- Add capability to simulate oxidation mediated diffusion

ALTERATIONS AND ENHANCEMENTS

- Improve assembling process of boundary conditions for the flow problem in the oxidation module
- Improve marking procedure for automatic geometry mesh refinement
- Resolve issue for selective physical etching in the presence of thin layers
- Resolve issue related to simulation of epitaxial growth
- Resolve issue where dopants in the ambient were ignored during annealing simulation

- Change API of the model function 'redep_emission' in the etching/deposition model library

VERSION 2.31.0

ALTERATIONS AND ENHANCEMENTS

- Resolve issue in diffusion module where, the reaction terms were not handled properly at domain boundary points

VERSION 2.29.1

NEW FEATURES

- Add parameter DIF.DONTKEEPDT to the DIFFUSE statement

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where the oxidation module failed in some test cases with more than two geometrical mesh levels

VERSION 2.29.0

NEW FEATURES

- Add parameter BOXREFINEGLOBAL to EXPORT statement

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where in some cases the simulator failed to set the oxidation parameters properly
- Resolve issue where in some cases the process mode of the EXPORT statement created very large structure files with a lot of regions
- Enable negative values for parameters BOXREFINE.X, BOXREFINE.Y and BOXREFINE.Z of the EXPORT statements
- Treat material barrier consistently in Monte-Carlo ion implantation module and analytical ion implantation module

VERSION 2.27.1

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where the alloy material was not properly re-deposited during ion milling simulation when running in multi-core mode
- Resolve issue related to a special behavior of the linear solver on RHEL5

VERSION 2.27.0

NEW FEATURES

- Add ion species Germanium and Carbon to implantation module

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where for high interstitial supersaturation (plus.one factor > 10) the dopant-defect pair concentration may have been unphysical high
- Improve consistency of model dependent numerical default parameters of 'five-stream' model and 'three-stream' model
- Add data for Indium and interstitial clustering to the ts4 section of material silicon
- Correct parameter niE in the ts4 section of material silicon
- Apply default configuration for diffusion when species are present in structure which are not handled by the diffusion models or which have no appropriate material parameters defined in the material database

VERSION 2.25.0

NEW FEATURES

- Extend 'three-stream' and 'five-stream' diffusion models by <311> interstitial clusters
- Make oxidation material parameters which are set within the deck fully re-entrant
- Add parameter OX.VERBOSE to DIFFUSE statement
- Add data to model doping dependent oxidation to the material database
- Add parameters REFLECTIVE and TRANSLATIONAL to the IMPLANT statement

- Add parameter GEO.EXPANDSCALE to the IMPLANT statement

ALTERATIONS AND ENHANCEMENTS

- Add data for crystal orientation dependent oxidation and for <311> interstitial cluster diffusion model to material silicon
- Adopt deck parameters to adjust oxidation material parameters to changes in material database
- The two temperature regimes of the linear and the parabolic rate coefficients for oxidation are represented as a single function in material database
- Add function 'twostage' to functional layer of material database
- Add function 'anisotropic-diamond' to functional layer of material database

VERSION 2.23.1

ALTERATIONS AND ENHANCEMENTS

- Remove quantities which are no longer valid anywhere in structure after diffusion
- Resolve issue where in some cases the oxide thickness obtained by the analytical oxidation was not conformal due to an inappropriate numerical solver for advancing the interfaces

VERSION 2.23.0

NEW FEATURES

- Materials with an etch rate of 0 are not even numerically affected by a physical etching process
- Extend implantation module with the capability to introduce <311> interstitial clusters
- Add parameters CLUSTER311, CLUST.FAC, MIN.CLUST, MAX.CLUST to IMPLANT statement
- Add statement CLUSTER

ALTERATIONS AND ENHANCEMENTS

- Add capability to add intrinsic doping when depositing material in planar mode
- A deck containing oxidation steps can now use the materials photoresist and resist193

VERSION 2.21.1

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where dopant annealing stage of an oxidation process hangs for very special doping conditions and volume data mesh configuration

VERSION 2.21.0

NEW FEATURES

- Extend linear and parabolic rate coefficients of oxidation module to depend on ambient pressure and HCl concentration in the ambient

ALTERATIONS AND ENHANCEMENTS

- Parameters for physical oxidation mode are derived from empirical linear and parabolic rate coefficients
- Add coefficients for oxidation pressure dependence and HCl concentration dependence
- Modify empirical oxidation data in material database to be described by means of Arrhenius functions
- The empirical oxidation parameters are specified for two temperature regimes

VERSION 2.19.1

ALTERATIONS AND ENHANCEMENTS

- Eliminate memory leak in diffusion module

VERSION 2.19.0

ALTERATIONS AND ENHANCEMENTS

- Make sure that all elements of the geometrical mesh at the domain boundary are properly refined within boxes
- Application names in all .str files created by VICTORY Process are made consistent
- Mirror refinement boxes when structure is mirrored by EXPORT statement

- No longer refine overlapping area when two refinement boxes overlap in EXPORT statement

VERSION 2.17.3

NEW FEATURES

- Enable rotation of refinement boxes in device mode of EXPORT
- Add parameters BOXTHETA and BOXPHI to EXPORT statement
- Link VICTORY Process with new tool ANSYSEXPORTER

ALTERATIONS AND ENHANCEMENTS

- Properly initialize defect and pair concentrations in a new epitaxial region before starting a diffusion simulation
- Properly orient all surface elements in surface mode of EXPORT

VERSION 2.17.2

NEW FEATURES

- Add new materials to the open material database : copper, iron, lead, nickel and tantalum
- Add data for materials silicon and tin
- Add conduction and thermal conductivity data for materials mosix, tasix, tisix, wsix and tiw
- Add ID and bulk/conduction data for materials alsi, alsicu, alsiti, alsix, nisix, pdsix, ptsix and zrsix

ALTERATIONS AND ENHANCEMENTS

- No virtual oxide layers are added anymore in between two oxidizable materials
- Improve export device algorithm with respect to creating a better mesh quality
- Improve surfaces mode of export to better handle manifold regions
- Change heat capacity and thermal conductivity data for the materials air and gas
- No longer invalidate oxidation induced stress profiles at the end of dopant annealing stage

VERSION 2.17.1

ALTERATIONS AND ENHANCEMENTS

- Scale last time steps of a diffusion simulation less aggressively

VERSION 2.17.0

NEW FEATURES

- Add parameters DIF.LINFILLLEVEL and DIF.LINFILLRATIO to METHOD statement
- Add parameters DIF.INITDT and DIF.MAXDT to DIFFUSE statement

ALTERATIONS AND ENHANCEMENTS

- Completely rework numerical engine for diffusion simulation
- Not only the annealing time is split among the various stages of applying the thermal budget to the dopants, but also the temperature ramp is split among the various stages
- Extend the applicability of interstitial trapping model beyond temperature of 1174 C

VERSION 2.15.1

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where in some cases (three-stream model / five-stream model) diffusion module sometimes produced inappropriate results when running in multi-core mode
- Improve export device algorithm with respect to better mesh quality

VERSION 2.15.0

ALTERATIONS AND ENHANCEMENTS

- Eliminate numerical artifacts and inaccurate solutions after oxidation in few test cases
- Resolve issue where, when the volume data mesh did not contain any quantities, the volume data mesh information was lost when saving simulation status by means of the statement STRUCT

VERSION 2.13.4

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where sometimes refinement lines got lost in ATHENA mode of REFINEMESH statement

VERSION 2.13.3

ALTERATIONS AND ENHANCEMENTS

- Improve export device algorithm with respect to better mesh quality

VERSION 2.13.2

NEW FEATURES

- Add parameters PSREMESH, ICMBASE, NOISOSTUFFING to EXPORT statement
- Refinement box for manual geometry mesh refinement can be chosen such that it automatically outlines a mask layer

VERSION 2.13.1

NEW FEATURES

- Add anisotropic mesh refinement capability to 'volumeonly' mode of EXPORT statement
- Add parameters BOXREFINE.X, BOXREFINE.Y and BOXREFINE.Z to EXPORT statement
- Add mirror capability to 'volumeonly' mode of EXPORT statement
- Resolve issue with 'unrefine' mode of REFINEGEOMESH statement

ALTERATIONS AND ENHANCEMENTS

- Change ID of material HfO2 to 224 in open material database
- Change abbreviation of material titanium nitride to TiNi, and its ID in open material database to 93

VERSION 2.13.0

NEW FEATURES

- Add virtual layer of oxide on top of each oxidizable material (if there is no oxide) at beginning of physical oxidation
- Multi-threading of analytical implantation module
- Improve the convolution integral calculation in analytical implantation module in order to reduce calculation time

ALTERATIONS AND ENHANCEMENTS

- Improve physical oxidation model in order to obtain more accurate results for structures like PBL
- Ensure that higher mesh levels are always properly nested within mesh of the lower level
- Improve 'volumeonly' mode of EXPORT statement

VERSION 2.11.6

NEW FEATURES

- Add parameter FX.NORMAL to deposition statements

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where, for a very special volume data mesh configuration and geometrical interface configuration, the diffusion simulation failed (even with the 'Fermi' model)

VERSION 2.11.5

NEW FEATURES

- Add export mode VOLUMEONLY
- Add capability to specifying x-composition of Si(1-x)Ge(x) for deposition
- Add parameter X.COMP to deposition statements
- Add parameter RREF.Z to GEOMETRYDEPO statement

ALTERATIONS AND ENHANCEMENTS

- Change material ID of HfO2 to 224 (from 1013) in open material database
- Add diffusion modeling data to materials HfO2, TiN and SiGe
- Add material SiGe as a default material for etching and deposition
- Rename material database file 'tinitride' to 'tin'

VERSION 2.11.4

ALTERATIONS AND ENHANCEMENTS

- Improve linear solver used by the diffusion and oxidation module in terms of accuracy and convergence rate

VERSION 2.11.3

ALTERATIONS AND ENHANCEMENTS

- Improve memory management in multi-core operation to obtain better multi-core performance

VERSION 2.11.2

ALTERATIONS AND ENHANCEMENTS

- Resolve stability problem in the oxidation module which is observed in one test case

VERSION 2.11.1

NEW FEATURES

- Extend 1D mode of EXPORT statement to extract 1D probes for all three Cartesian mesh directions
- Add materials teos and oxide1 to material database

ALTERATIONS AND ENHANCEMENTS

- Improve time step control of diffusion module to properly handle any case, where very large time errors are tolerated for diffusion simulation
- Reduce memory consumption of diffusion module in multi-core operation

VERSION 2.11.0

NEW FEATURES

- Assemble interface equations in diffusion module on multiple CPUs

ALTERATIONS AND ENHANCEMENTS

- Set multi-threaded preconditioner 'ilk' as default preconditioner for oxidation module
- Further improve accuracy of oxidation module
- Reduce size of the files created by process mode of EXPORT
- Resolve data smoothing issue in implantation module

VERSION 2.9.2

NEW FEATURES

- Add support for a new linear preconditioner called 'ilk'
- Add parameter STABILITYLIMIT to DIFFUSE statement
- Enable multi-threading capability (multi-threaded factorization) of the 'ilk' preconditioner for oxidation simulation
- Support for system wide linear solver configuration files (installed by means of SMAN)

ALTERATIONS AND ENHANCEMENTS

- Precondition the oxidation flow equations in the flow equation assembler before handing them over to the linear solvers
- Improve linear solvers for diffusion and oxidation with respect to performance

VERSION 2.9.1

ALTERATIONS AND ENHANCEMENTS

- Implement an improved data interpolation for geometry mesh update (during automatic refinement)
- Restore original meaning of “alias”file in material database to improve backward compatibility

VERSION 2.9.0

NEW FEATURES

- Invalidate oxidation induced stress data by etching or deposition steps

ALTERATIONS AND ENHANCEMENTS

- Split the material database file 'common/smdb/alias'
    - 'alias' file contains the aliases for materials only
    - 'element_alias' file contains aliases for impurity elements
- Resolve an issue in oxidation module to give higher accuracy for special geometrical configurations
- Improve deck syntax error messages

VERSION 2.8.11

ALTERATIONS AND ENHANCEMENTS

- Resolve issue where plus-one model was activated when the parameter plus.one=off