

Variability increases the difficulty of BEOL/MOL/FEOL technology qualification. The authors from Renesas Electronics found the concave shape of lifetime data on a Weibull plot can be expressed by superposition of several Weibull distributions with a different scale parameter (η). Traditionally, the concave shape of lifetime data is explained by time-dependent clustering (TDC) model. By assuming (i) variation of electric field causes the variation of η and (ii) oxide breakdown follows the E-model, the authors demonstrate that TDDB data can practically be used to extract the electric field distributions and the space variations as well. This work advances the statistical analysis of the clustering model.

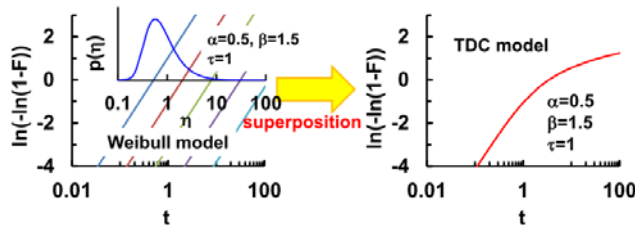


Fig. A. Concave shape of lifetime data on a Weibull plot (the right one) can be expressed by superposition of several Weibull distributions with a different scale parameter (η).

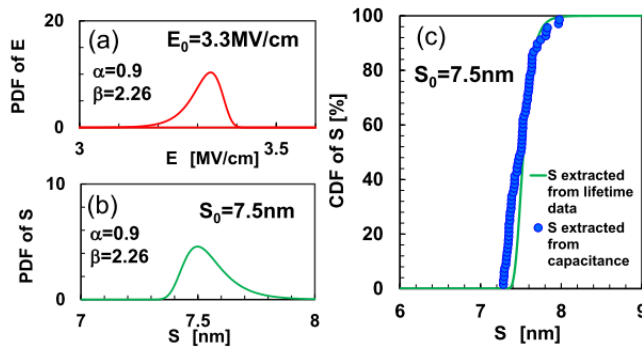


Fig. B. The distributions of electric field (a) and dielectric thickness (b) are extracted from the TDDB lifetime data of the MIM capacitors, based on the proposed superposition concept and the oxide E-field induced η variation. The extracted dielectric thickness CDF is consistent with capacitance data (c).