A model for comprehensive studies of porosity in mesoporous low-k dielectrics

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The successful integration of a low-dielectric-constant (low-k) material as an interlayer dielectric (ILD), as well as its resistance to a hostile (chemical, thermal, radiation, etc.) environment depends on the morphology of the embedded porosity. This is a preliminary comprehensive study based on a simple percolation model, which is applied to represent randomly packed non-interacting hard (non-overlapping) spheres (pores). Analysis of the number of connected and isolated pores is used to evaluate the pore connectivity at a given porosity below the onset for percolation. These results are related to some of the presently available ILD candidates for the 0.13 μm feature-size generation. The importance of the percolation threshold, at which an “infinite” pore cluster is formed, will be assessed in the light of the requirements given in the International Technology Roadmap for Semiconductors. The feasibility of the model for studying changes in material properties and the possibilities for future developments will be discussed.