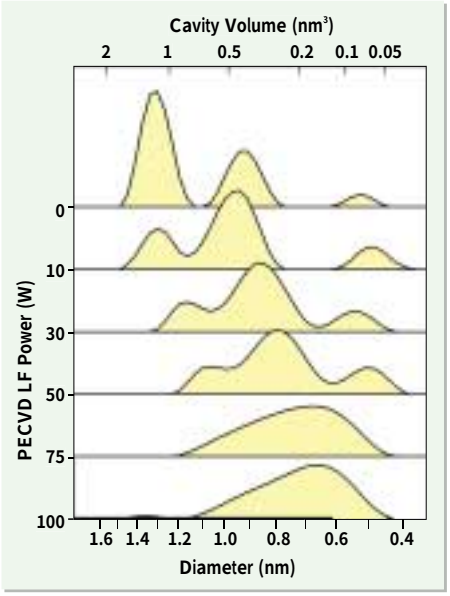
Characterization of Sub-Nanometer-Sized Voids in Low-Dielectric-Constant Films by a Slow Positron Beam

For future generation high-speed LSI devices, copper interconnection with low dielectric constant (low-k) interlayer films is required to decrease RC(R: interconnect resistance, C: interlayer dielectric capacitance) delay. Recently, a new process for low-k films, utilizing dual frequency plasma enhanced chemical vapor deposition (PECVD) with source gas of polysiloxane, has been developed for copper damascene integration. To characterize micro-structures in the PECVD grown low-k films, we have carried out positron-positronium lifetime measurements with a slow positron beam. We have found sub-nanometer-sized voids and clear relation between the void size and dielectric constant.



Pore size distribution of low-k films grown by the PECVD method with low-frequency power of 0, 10, 30, 50, 75, and 100 W.

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Decomposition of Dioxins by Photocatalytic Ecomaterial

Photocatalytic ecomaterial is prepared by coating TiO_2 transparent film on silica-gel bead. When irradiated by light, the photocatalytic ecomaterial generates strong oxidative potential and almost all organic substances are decomposed to water, carbon dioxide and others. An apparatus for decomposition of dioxins is constructed with the ecomaterial. The removal efficiency over 99% of dioxins has been obtained. The novel photocatalytic decomposition method using silica-gel beads coated by TiO_2 has been applied for the highly efficient treatment of water pollutants, acidic gases, and rank odor substances in environment.

Apparatus for decomposition of dioxins with photocatalytic ecomaterial

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