Elucidation of spatiotemporal reactions in nano-space by femtosecond pulse radiolysis

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【Outline of survey】

The semiconductor industry is based on the lithography technique which has been advanced from year to year, reaching fabrication less than 100 nm in 2004. The scale of lithography will enter, so-called, "nano lithography" in the next ten years, in which 32 nm scale fabrication will be required with 1.2 nm accuracy. The present mass production of ～100 nm scale features has been performed by ArF or KrF excimer laser. However, the laser lithography is thought to reach a fabrication limit in near future. Quantum beam such as an electron beam (EB) and an extreme ultra violet (EUV, 13.4 nm) is expected to be used as an exposure source in the next generation lithography. However, to date, the basic researches on the quantum beam-induced reactions have not been established yet, although they have a significant potential for the application use in industries because of their fine convergence.

Under the abovementioned background, the purpose of this research is the establishment of scientific aspect on quantum beam-induced reactions in nano-space in order to realize effective use of quantum beam for novel applications such as nano-lithography. This purpose is approached by the researches on quantum beam-induced chemical reactions in nano-space in terms of the dynamics of intermediate species from energy deposition processes to the time evolution of the spatial distributions.

【Expected results】

The details of nano-space reactions will be elucidated by the combination of direct measurements of spatiotemporal reactions by originally-developed femtosecond pulse radiolysis, observation of nano features fabricated by electron beam lithography, and simulation based on these experimental results. The detailed aspects on the quantum beam-induced reaction in nano-space will give a significant impact on the industries in which the development of intelligent materials for nano-lithography is a crucial mission. Although this research project is a basic research on the nature of quantum beam-induced reactions, it can give clear solutions to technical problems which the industrial companies have struggled with. The obtained output by this project will contribute to the expansion of the use of quantum beam in the field of advanced application in terms of nano-space reactions.

【References by the principal researcher】

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【Term of project】 FY 2005 - 2008 | 【Budget allocation】 84,100,000 yen

【Homepage address】 http://www.bms.sanken.osaka-u.ac.jp/eng/