

Author: [ADVANCED](#) | Volume Page
Keyword: |



[TOP](#) > [Available Issues](#) > [Table of Contents](#) > [Abstract](#)

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[\[PDF \(581K\)\]](#) [\[References\]](#)

Evaluation of Outermost Surface Temperature of Silicon Substrates during UV-Excited Ozone Oxidation at Low Temperature

[Naoto KAMEDA](#)¹⁾²⁾, [Tetsuya NISHIGUCHI](#)¹⁾²⁾, [Yoshiki MORIKAWA](#)¹⁾,
[Mitsuru KEKURA](#)¹⁾, [Ken NAKAMURA](#)²⁾, [Tomoharu USHIYAMA](#)²⁾, [Hidehiko NONAKA](#)²⁾ and [Shingo ICHIMURA](#)²⁾

1) Meidensha Corporation

2) National Institute of Advanced Industrial Science and Technology (AIST)

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Using ultraviolet (UV)-excited ozone gas, we prepared high-quality SiO₂ films that can be used as gate dielectric films on poly-silicon or silicon wafers without sample heating. The UV-excited ozone gas was generated by UV irradiation of highly concentrated ozone gas. During the UV-excited ozone process, UV light irradiates the sample surface directly through the ozone gas. Then, the temperature at the sample surface is increased by UV-light absorption at the surface. Estimation of this surface temperature is important for understanding the oxidation mechanism. We estimated the surface temperature obtained during UV irradiation to be about 300°C by investigating the temperature dependence of the oxidation rate for oxygen gas. We have previously determined that almost no thermal decomposition of ozone gas occurs at this temperature, and that oxygen gas does not oxidize the Si substrate. Therefore, we concluded that the only oxidation species in the UV-excited ozone process is UV-excited ozone O(¹D).

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