

Semiconductor Technology from A to Z

Oxidation

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Overview

Application of Oxide Layers

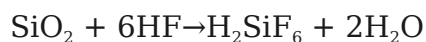
Oxide is used in semiconductor manufacturing in a wide variety of fields:

- for isolation (e.g. [between metallization layers](#))
- as a scatter layer (e.g. [ion implantation](#))
- as an adaptation layer (e.g. [LOCOS technique](#))
- for planarization (e.g. [to soften edges](#))
- as a masking layer (e.g. [diffusion](#))
- as alignment marks (alignment points in photolithography)
- as a protective layer (against mechanical damage)

Properties of oxide layers

In combination with silicon, oxide appears as silicon dioxide (SiO₂). It can be deposited on the wafer in very thin, highly uniform layers.

SiO₂ is very resistant and in semiconductor manufacturing can only be wet-etched by hydrofluoric acid (HF). Water and other acids do not attack the oxide; due to the risk of contamination by metal ions, alkaline solutions (KOH, NaOH, etc.) cannot be used. These, however, play a role in micromechanics for [anisotropic wet etching](#) – there they attack the silicon while the oxide remains virtually untouched, which is exactly why it serves as a mask. The removal process with HF proceeds according to the following reaction:



Furthermore, oxide is well suited for circuit functions, as it meets a wide variety of requirements (e.g. as [gate oxide](#), field oxide, or interlayer dielectric).

What matters here is less the oxide itself than the interface to the silicon. It can be thermally grown with such a low defect density that a transistor switches reliably across it. No other semiconductor has its own oxide with this property – this is the main reason why silicon has prevailed over materials that would actually be more favorable electrically.