Starting Material

150 mm, p-type, <100>, 36-63 ohm-cm

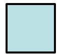
Silicon substrate

Attila Horvath
2005

Pad Oxidation and Nitride Deposition

Silicon substrate

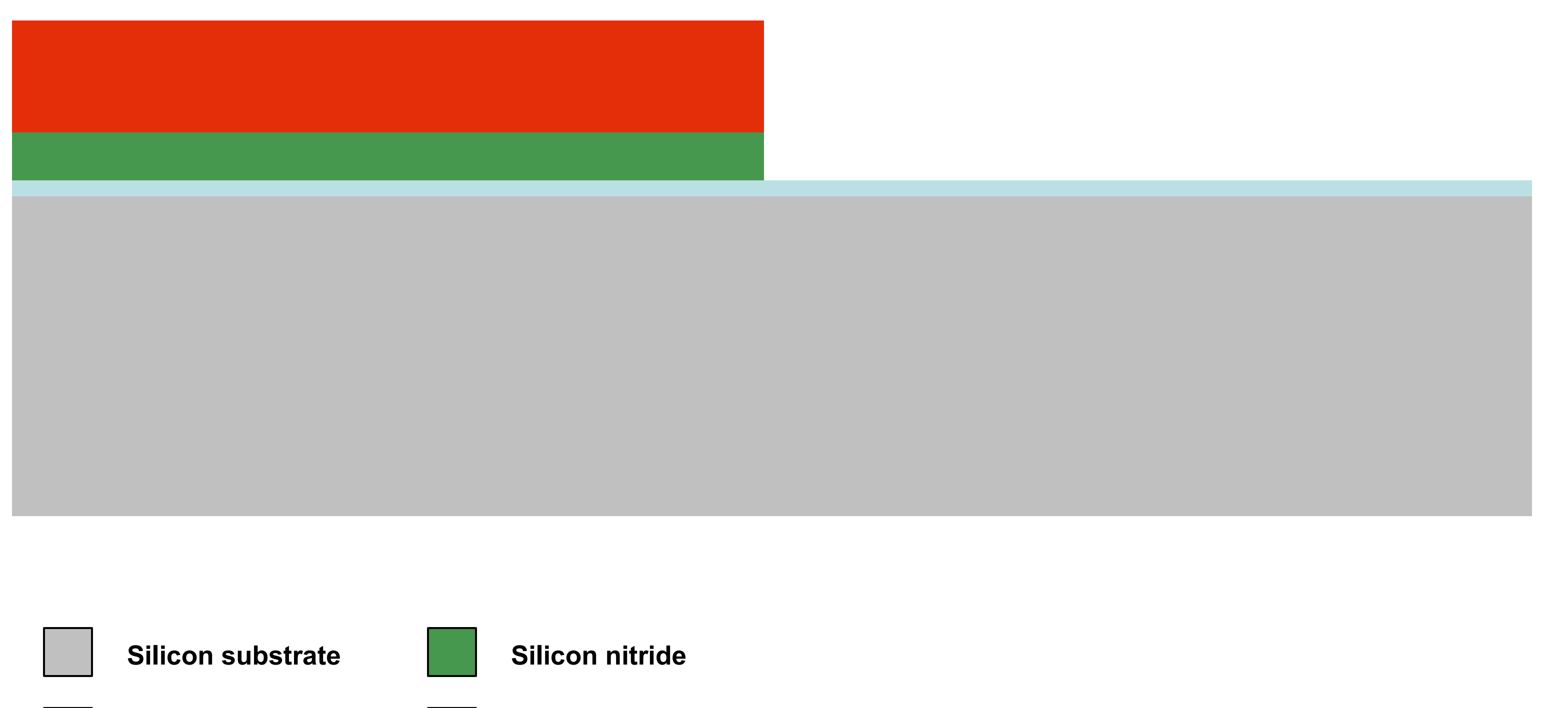
Silicon nitride = 2200A



Pad oxide = 250A

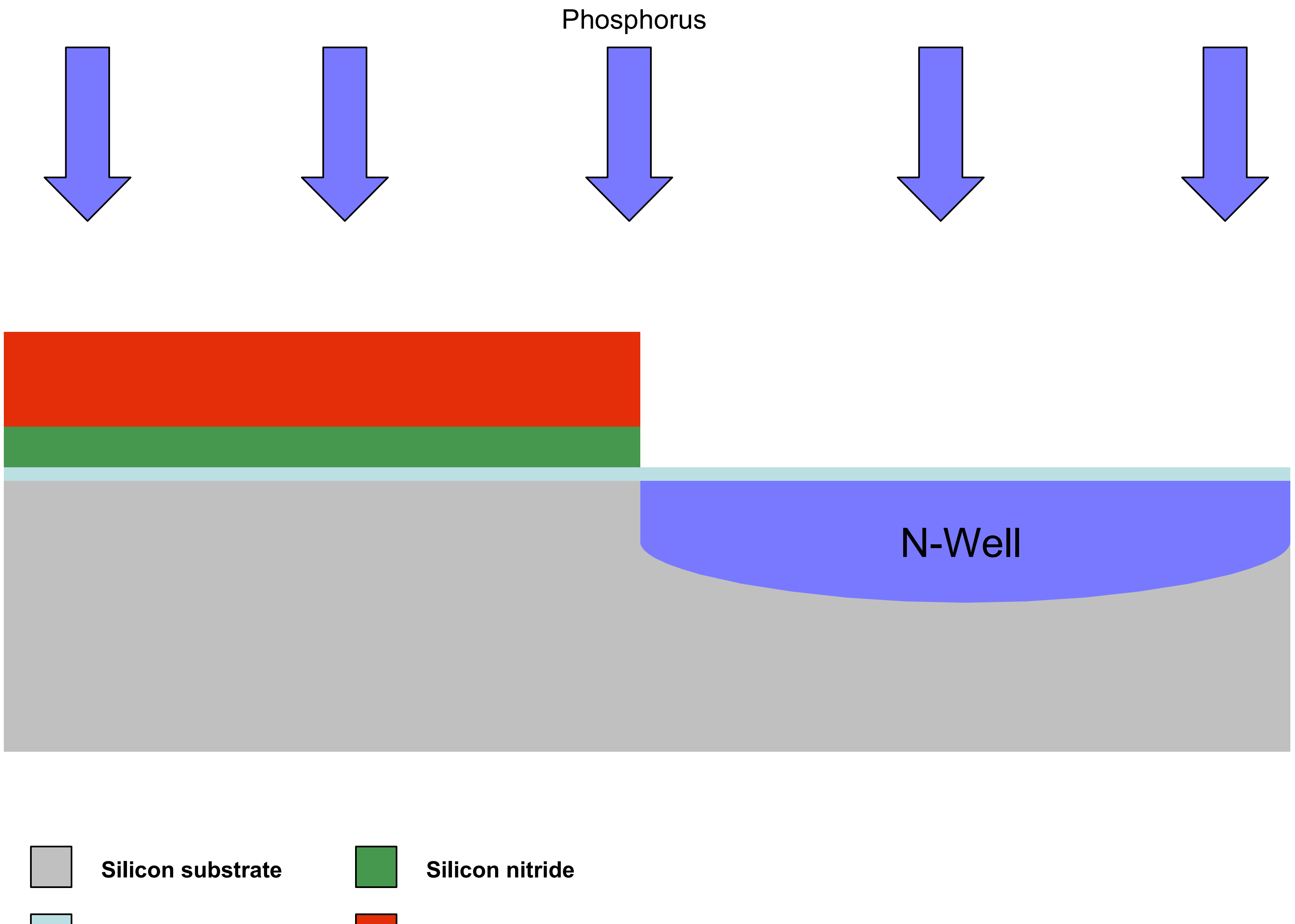
Attila Horvath
2005

N-Well Photo and Nitride Etch



Attila Horvath
2005

N-Well Implant

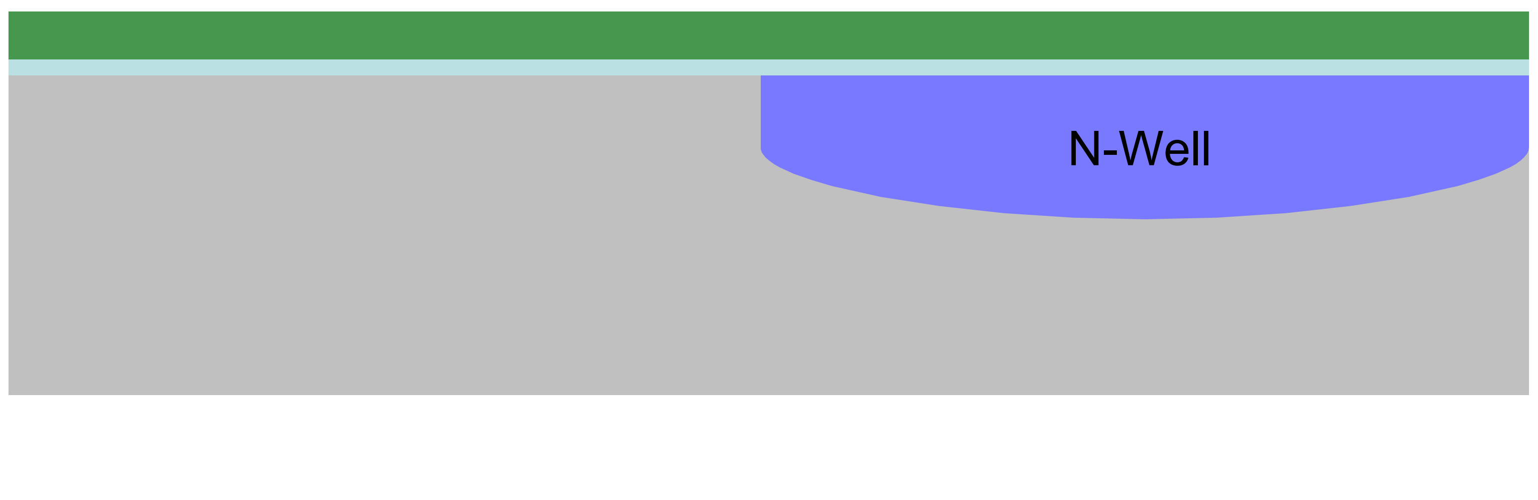


Attila Horvath
2005

Nitride and Oxide Removal

Attila Horvath
2005

Pad Oxidation and Nitride Deposition

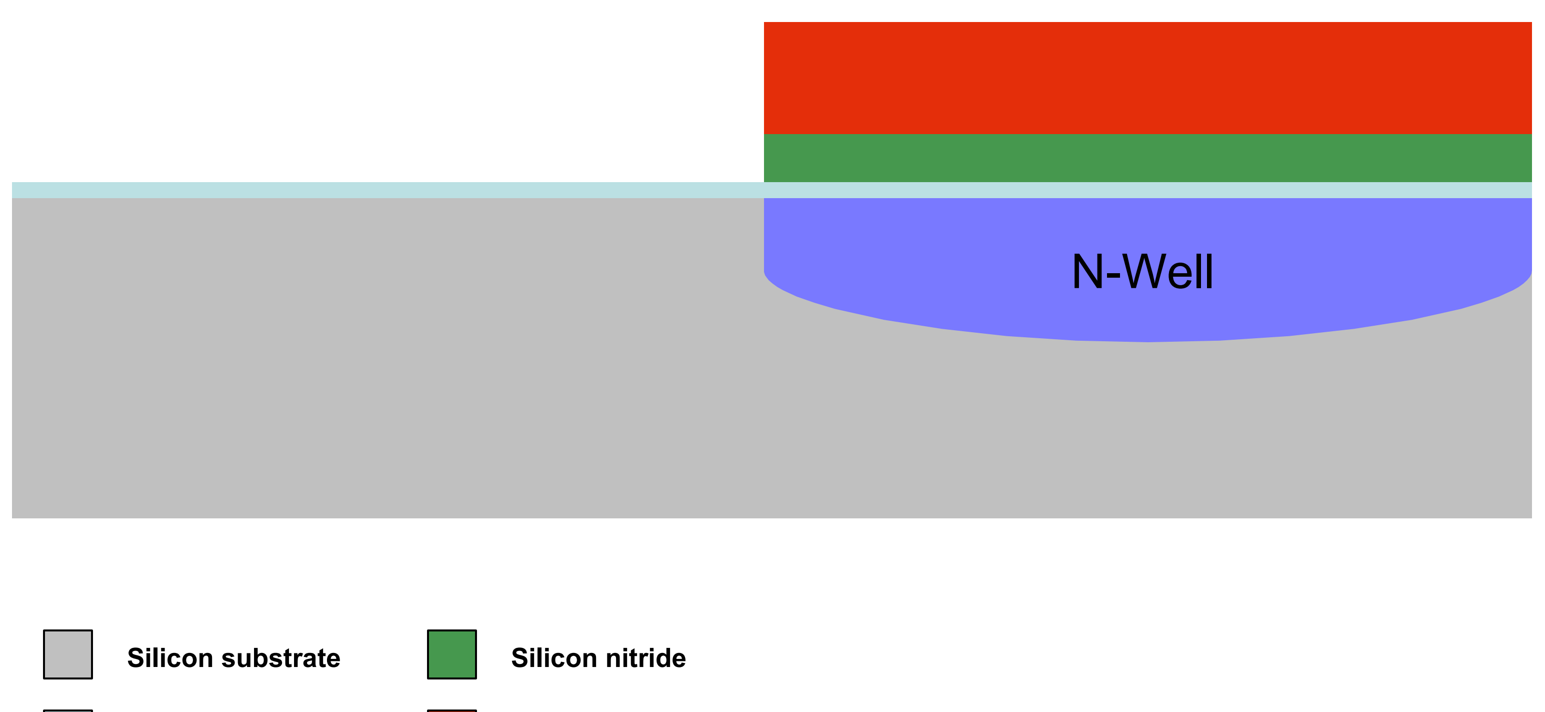


Silicon substrate

Silicon nitride = 2200A

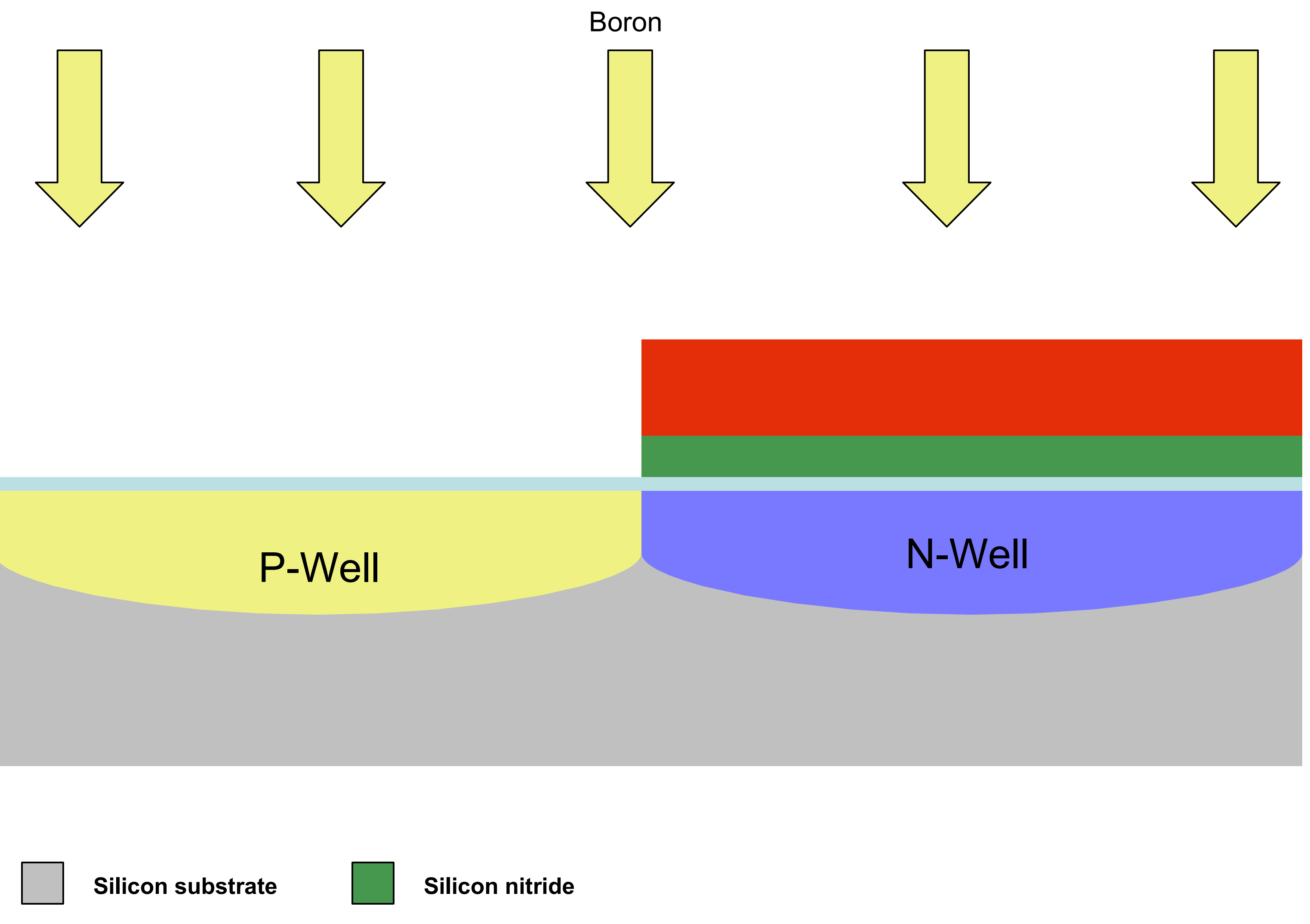
Attila Horvath
2005

P-Well Photo and Nitride Etch



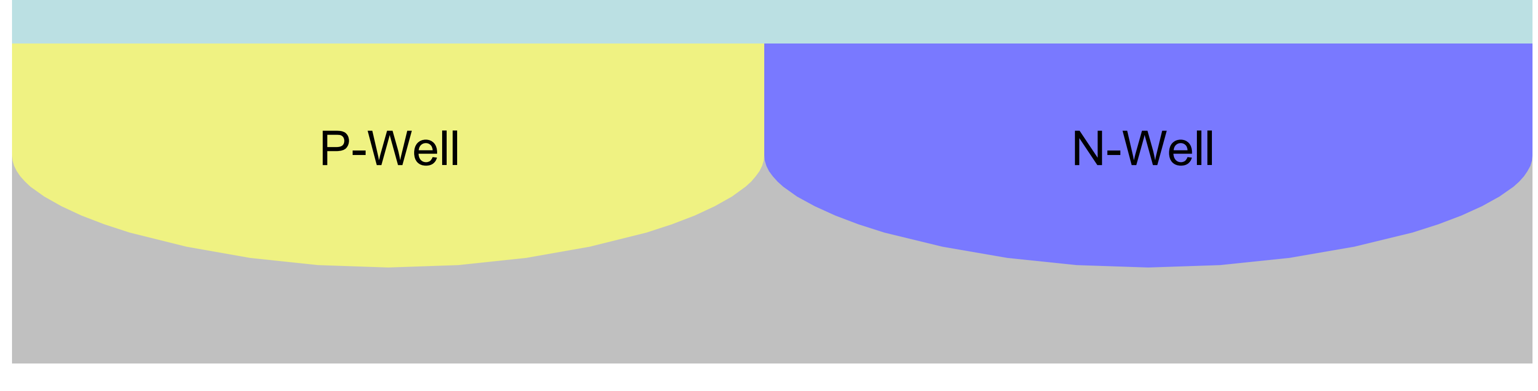
Attila Horvath
2005

P-Well Implant



Attila Horvath
2005

Nitride Removal and Well Drive-In

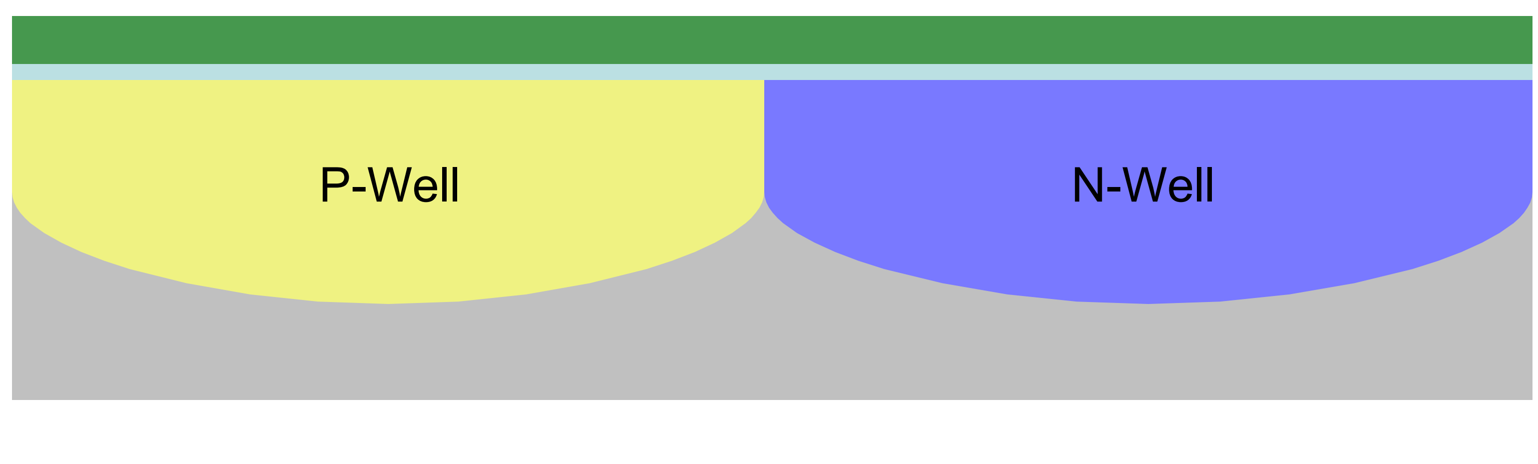


Silicon substrate

Oxide

Attila Horvath
2005

Pad Oxidation and Nitride Deposition



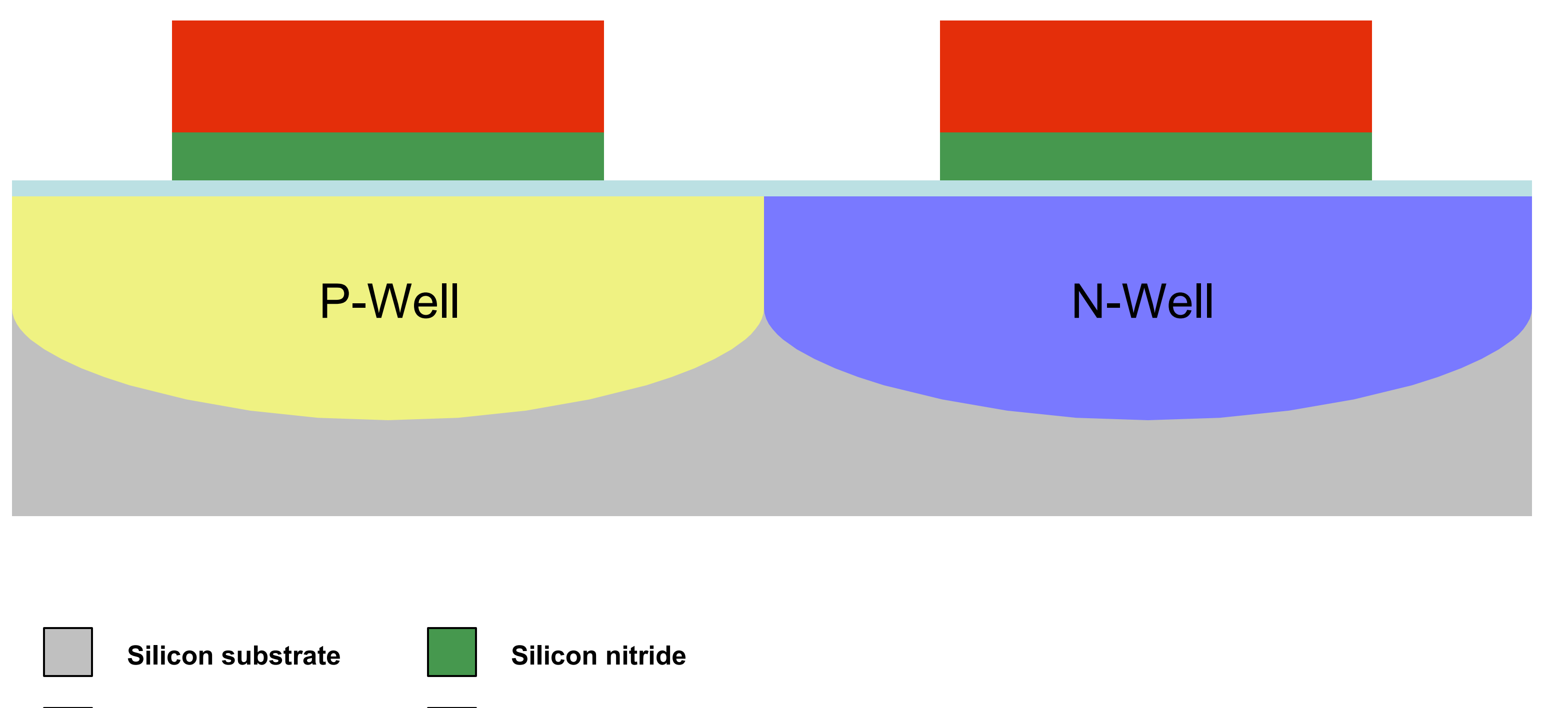
Silicon substrate

Silicon nitride = 2200A

Pad oxide = 250A

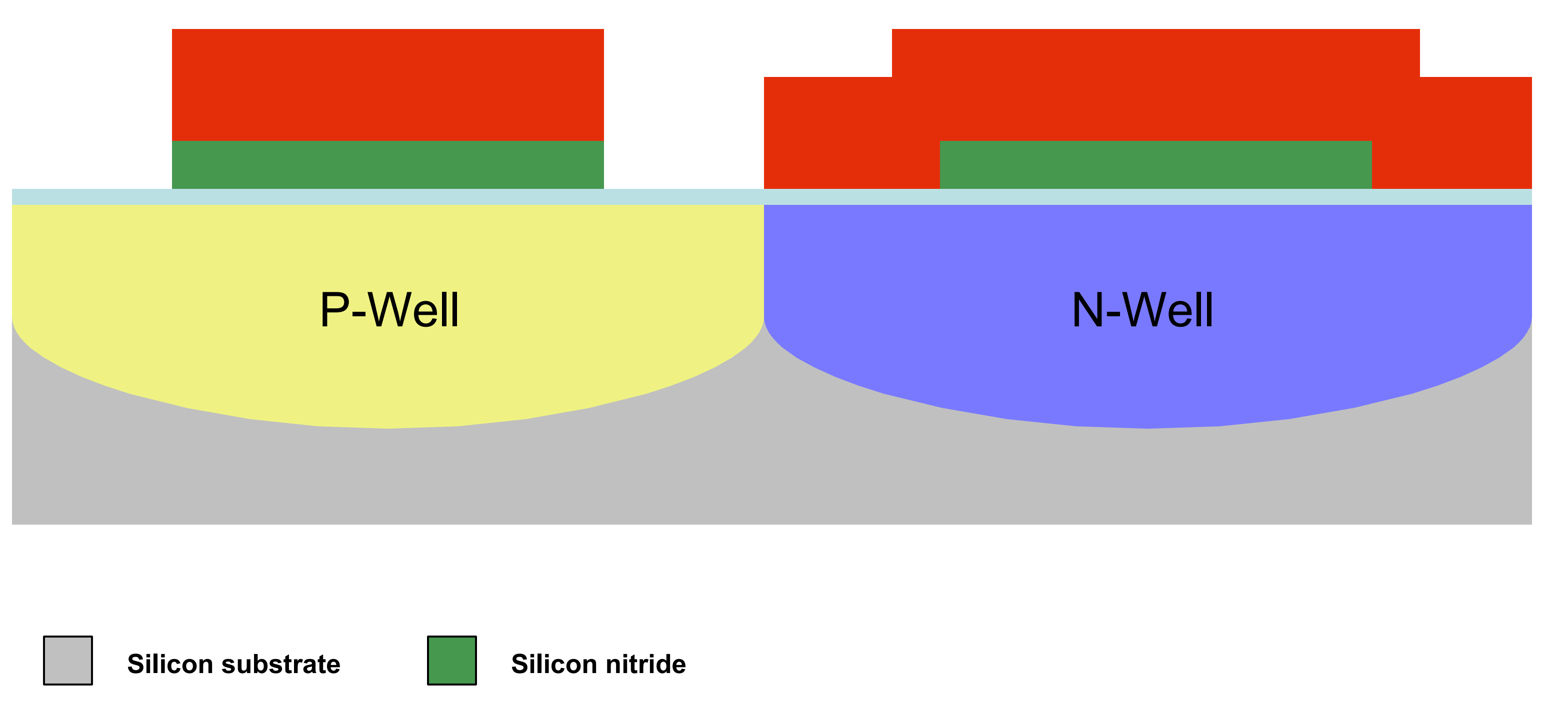
Attila Horvath
2005

Active Area Photo and Nitride etch



Attila Horvath
2005

P-Well Field Implant Photo



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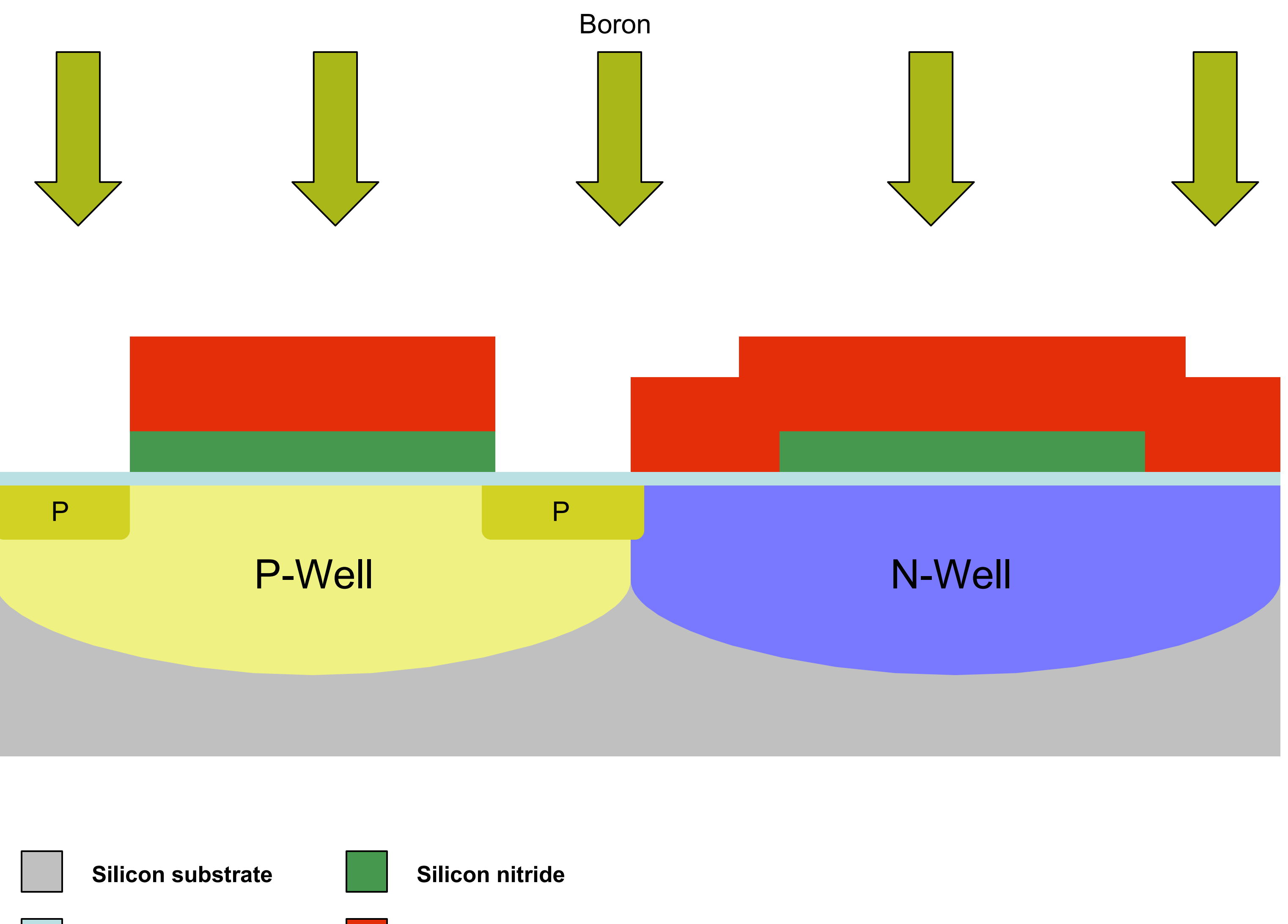
2005

P-Well Field Ion Implant



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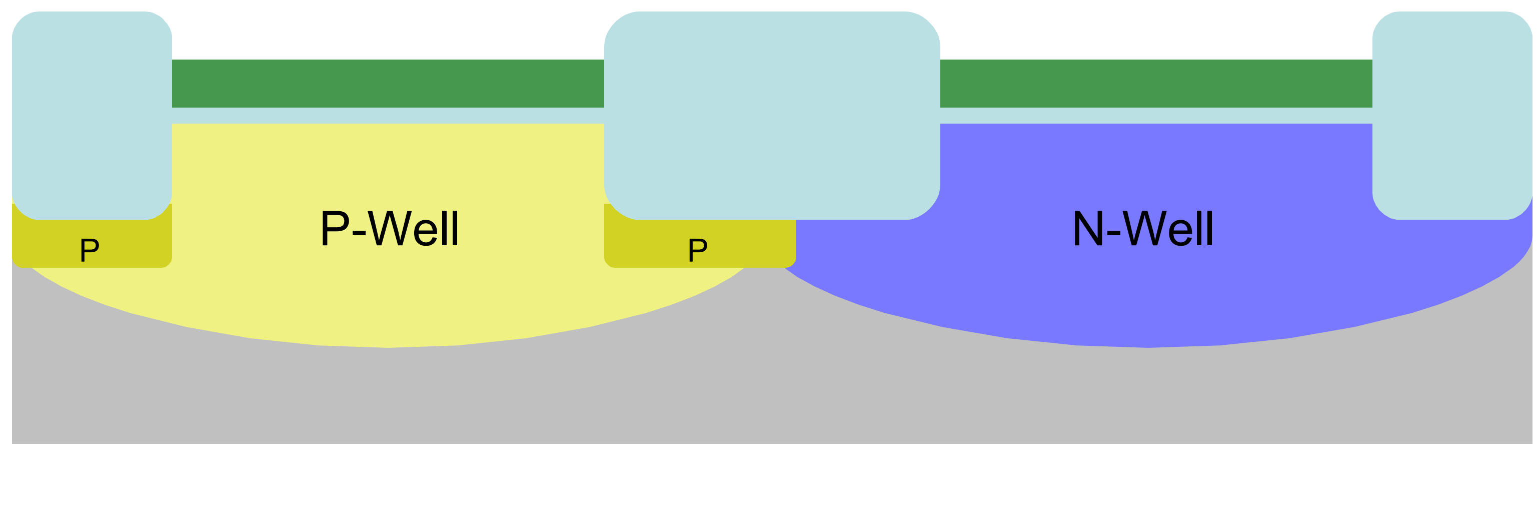
2005

LOCOS Oxidation



Silicon substrate

Silicon nitride

Oxide

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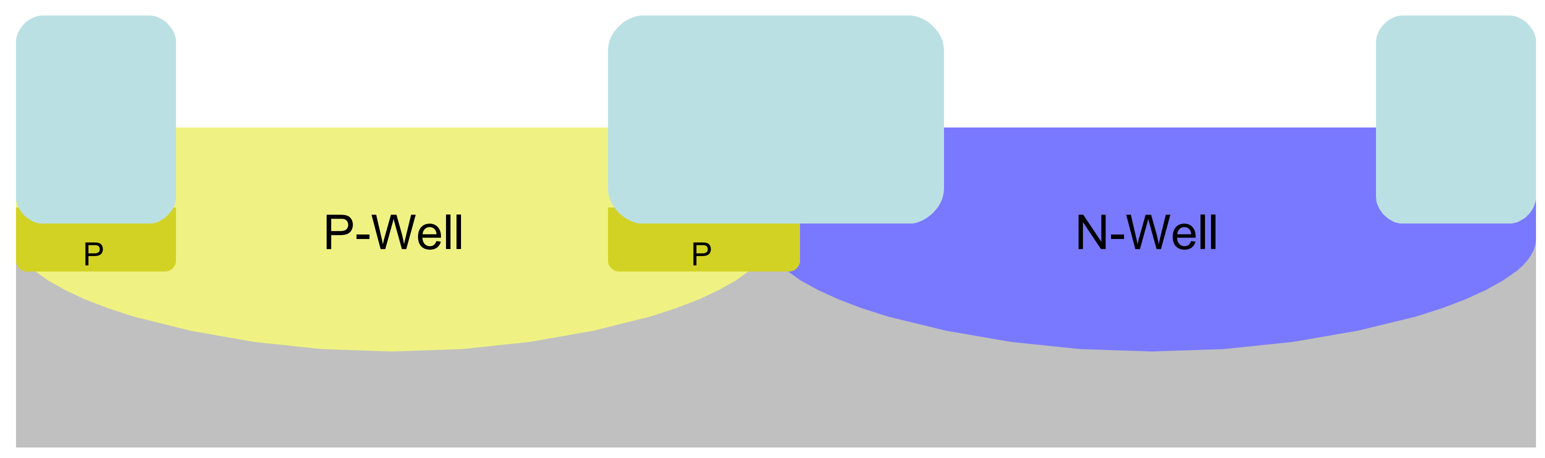
2005

Nitride and Oxide Removal

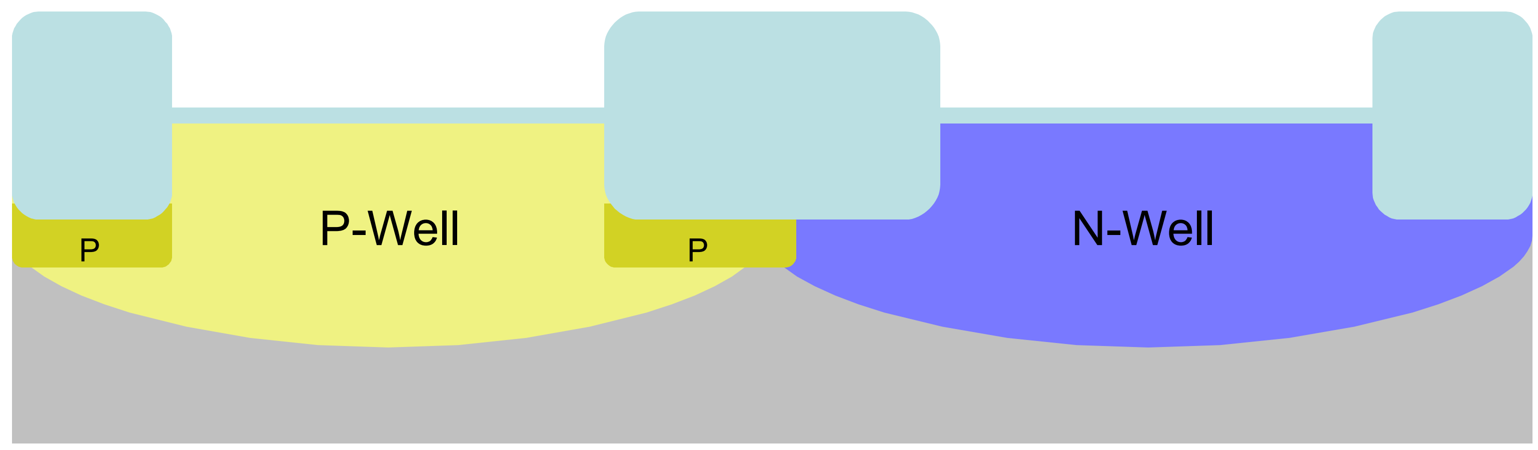


Silicon substrate

Oxide

Attila Horvath
2005

Screen Oxidation

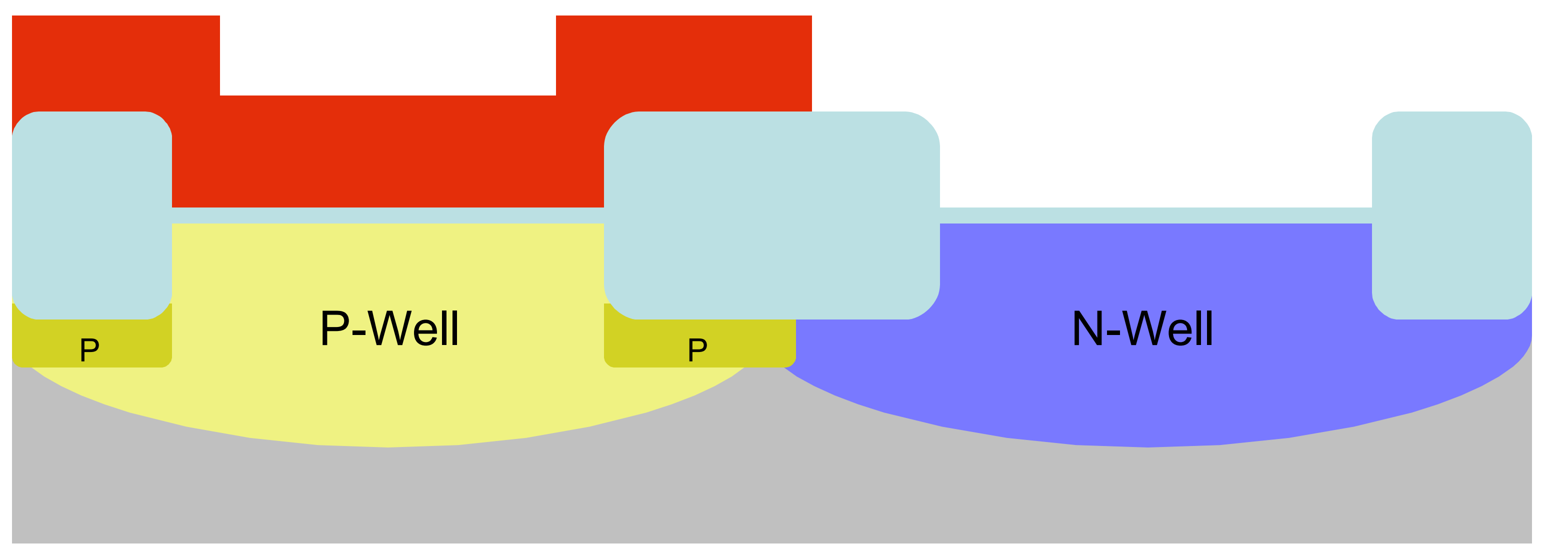


Silicon substrate

Screen Oxide = 250A

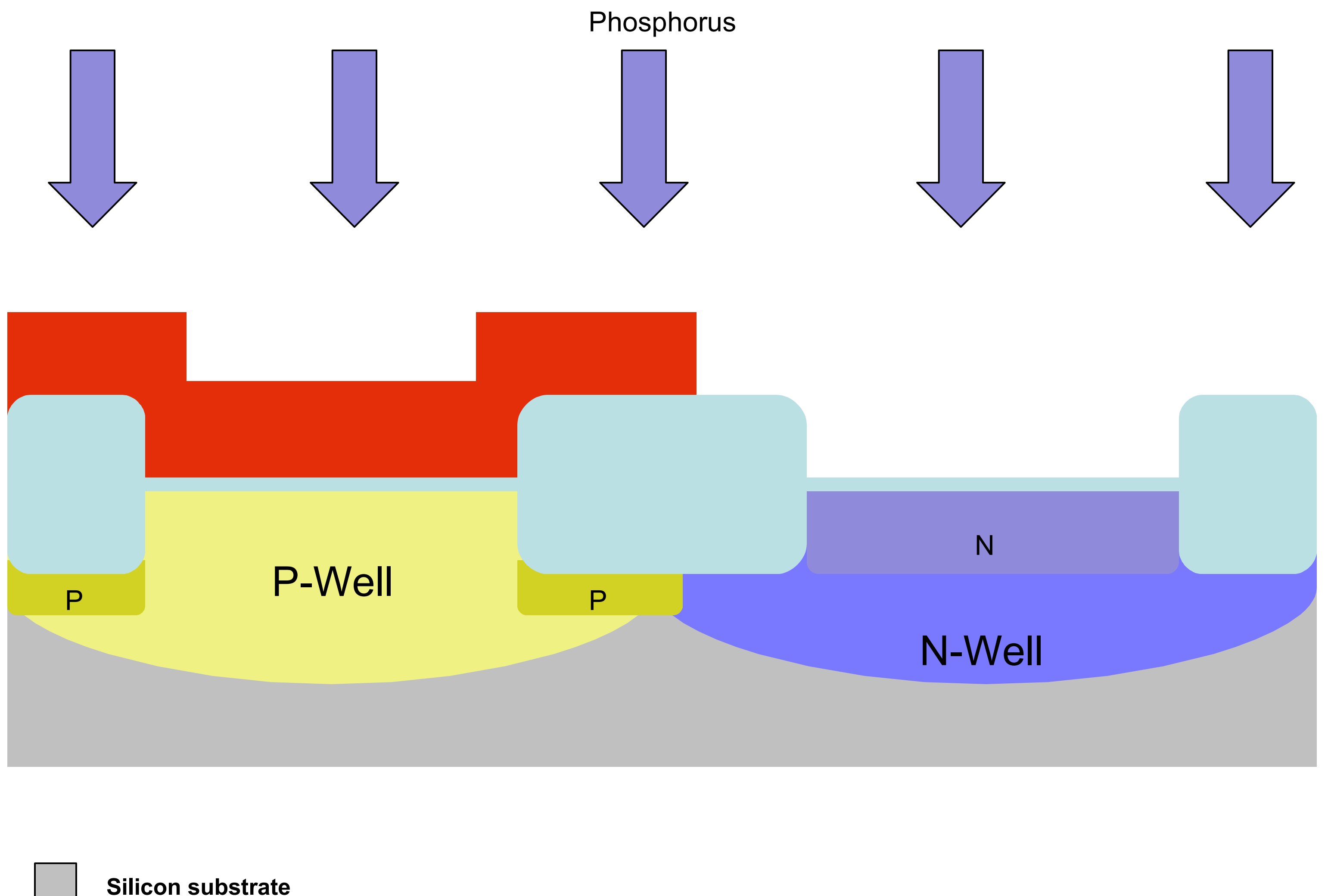
Attila Horvath
2005

PMOS Vt Adjustment Implant Photo



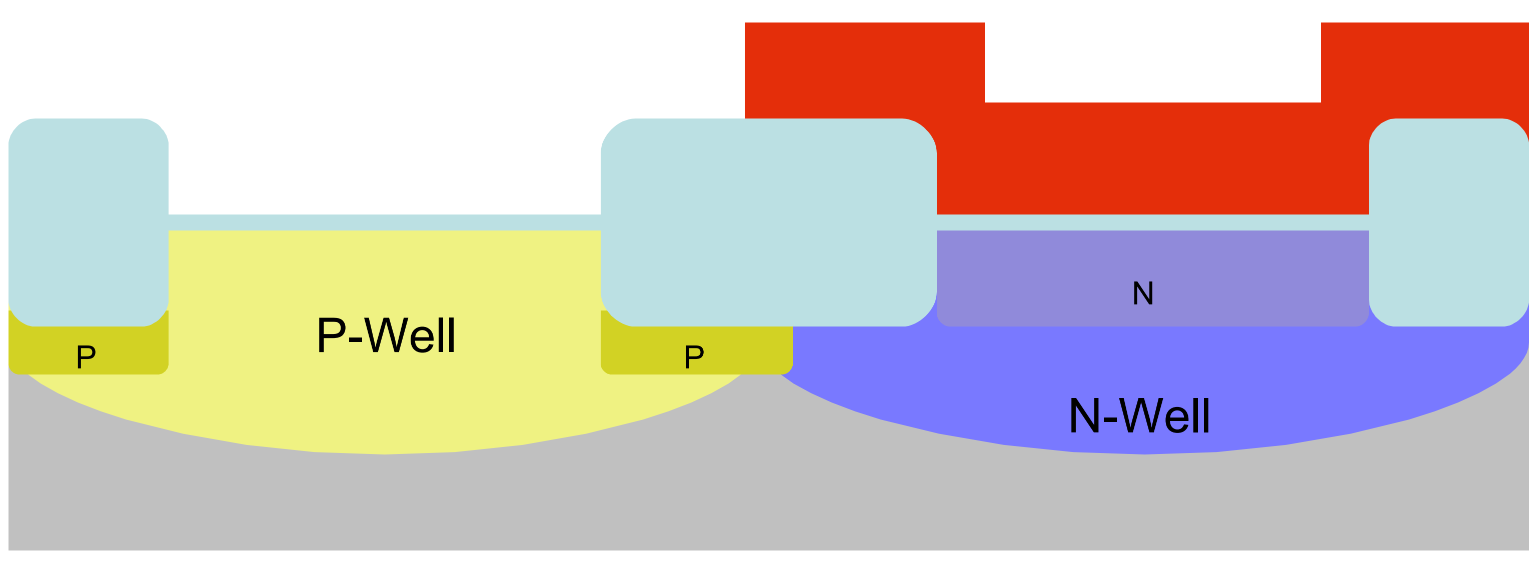
Attila Horvath
2005

PMOS Vt Adjustment Implant



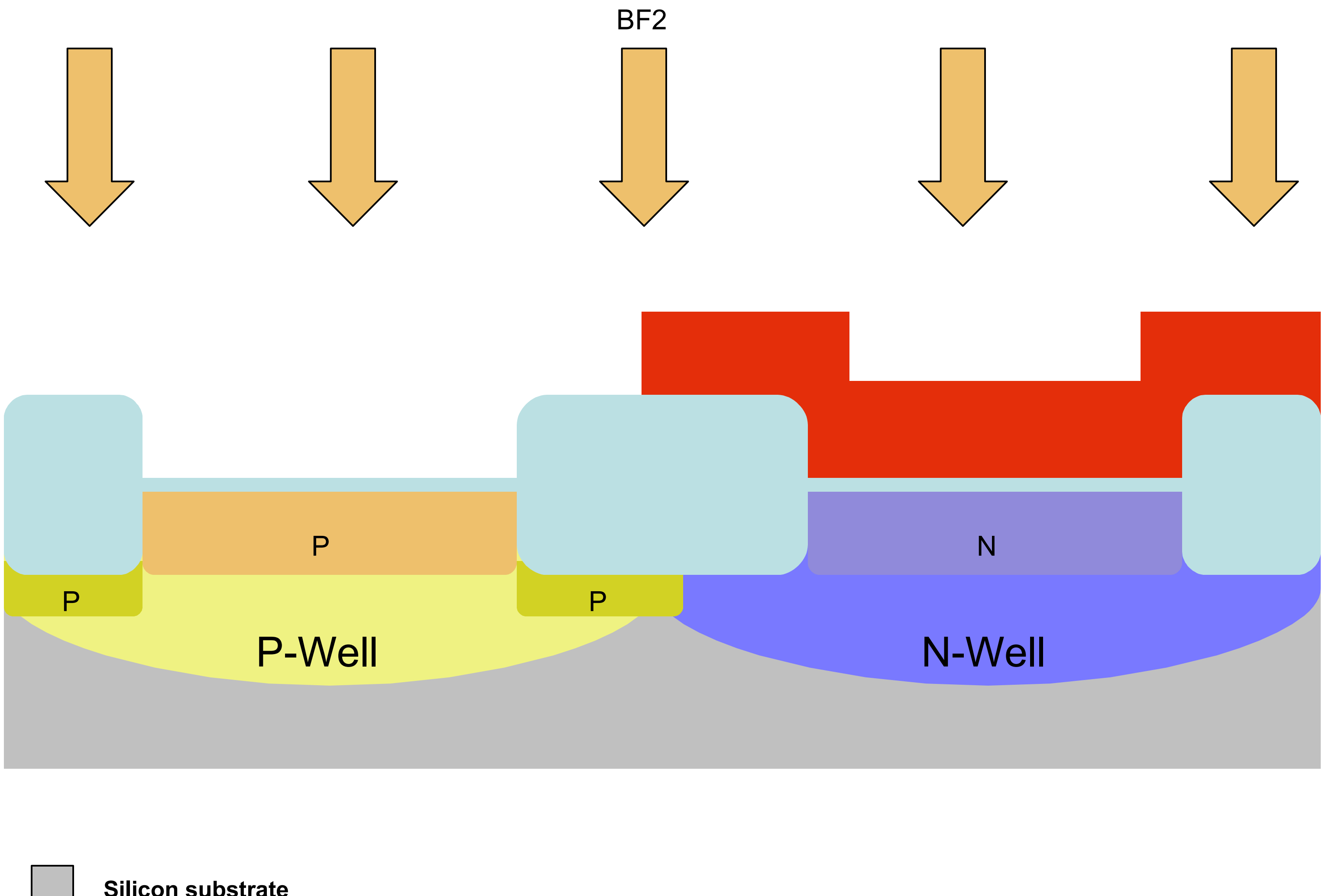
Attila Horvath
2005

NMOS Vt Adjustment Implant Photo



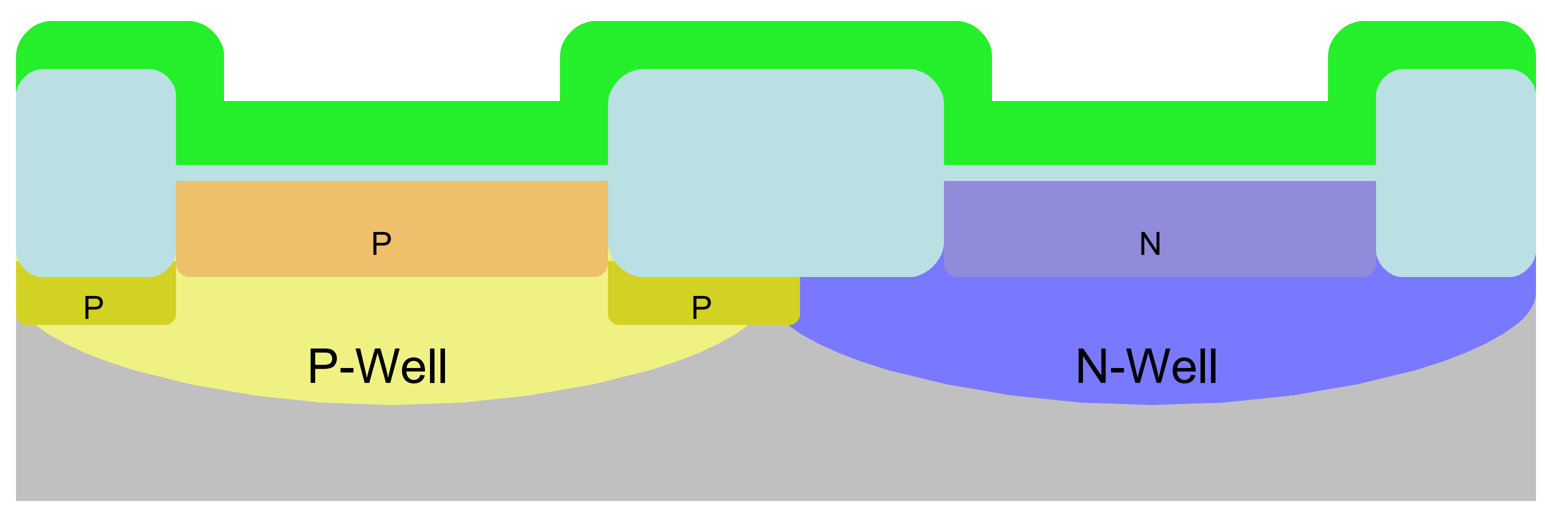
Attila Horvath
2005

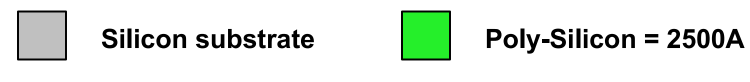
NMOS Vt Adjustment Implant



Attila Horvath
2005

Gate Oxidation and Poly-Silicon Deposition





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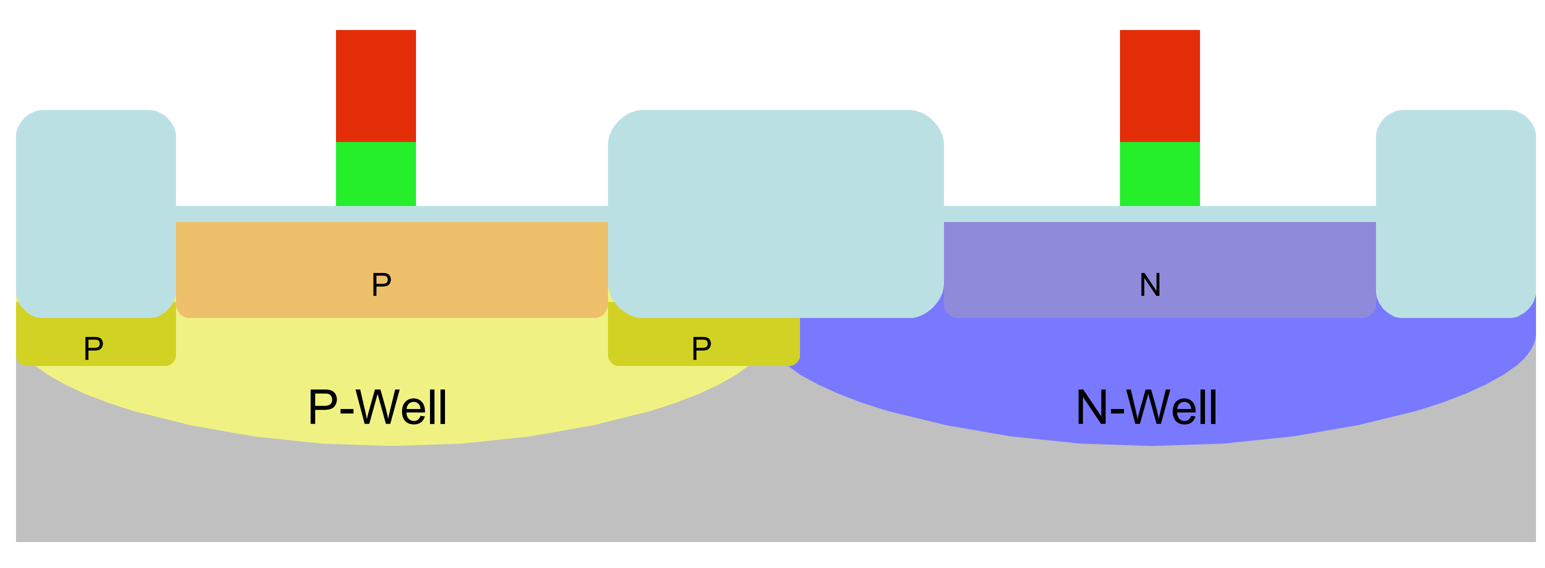
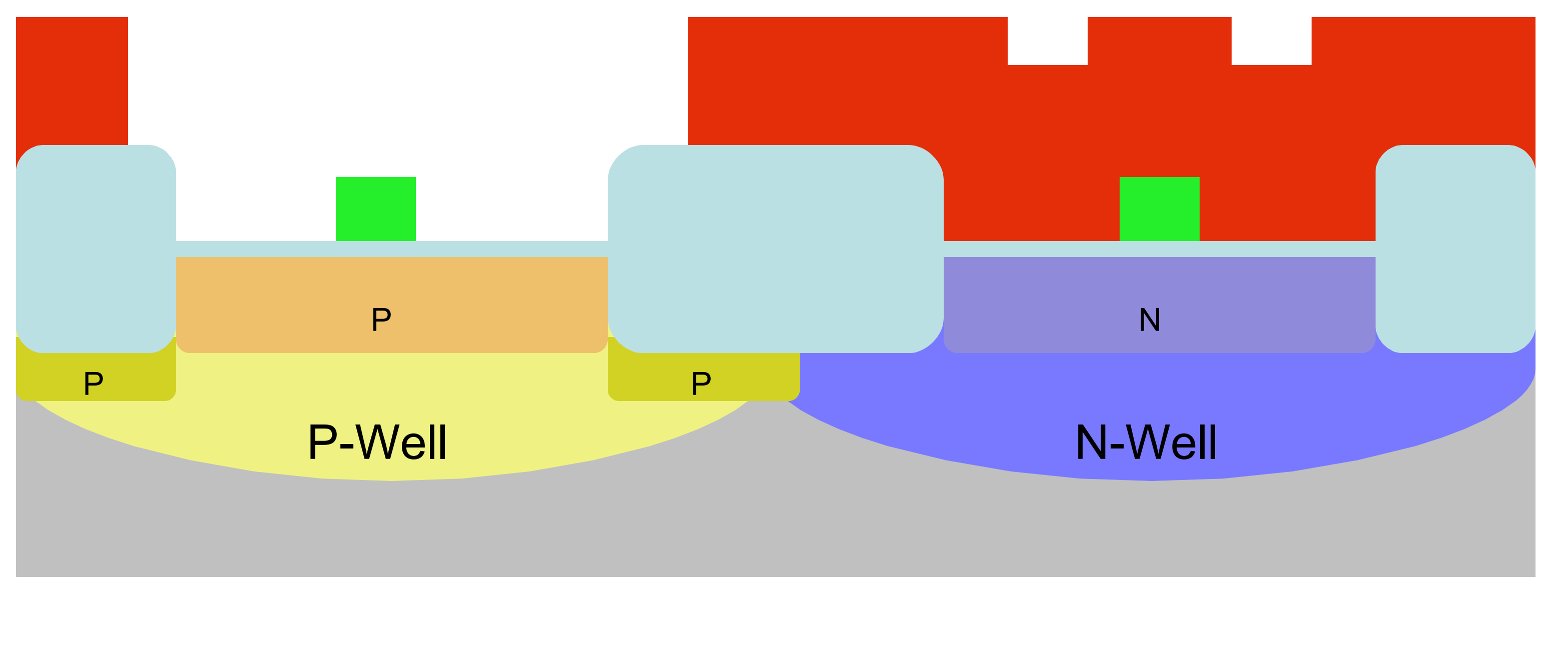
2005

Poly Gate Photo and Etch



Attila Horvath
2005

NMOS LDD Implant Photo



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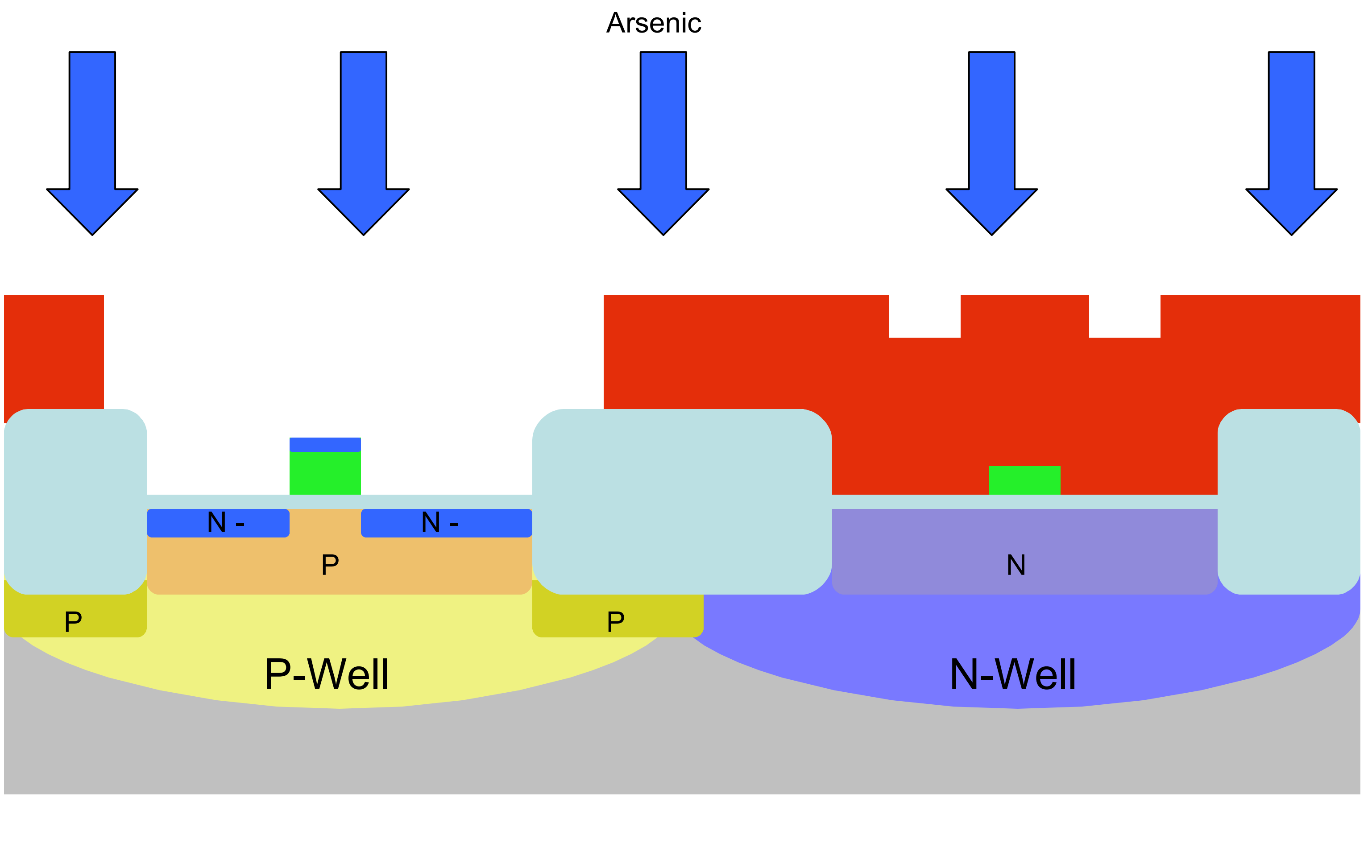
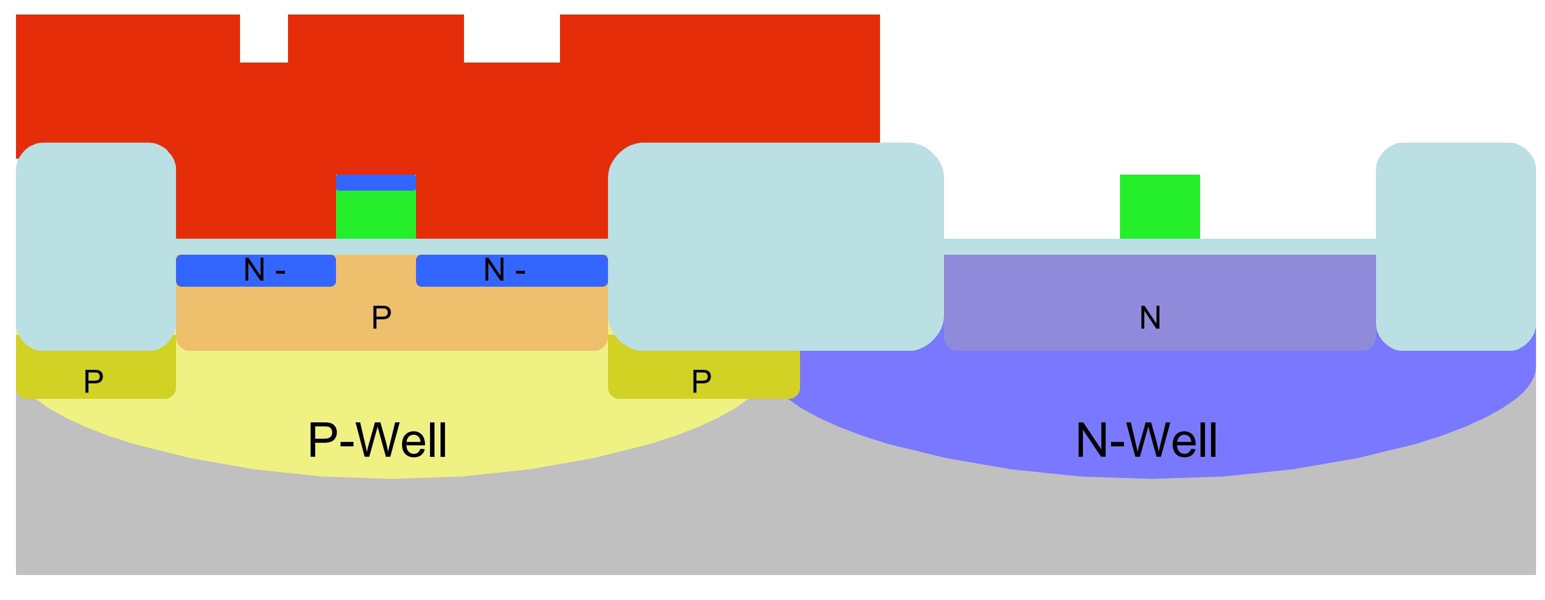
2005

NMOS LDD Implant



Attila Horvath
2005

PMOS LDD Implant Photo



Silicon substrate

Poly-Silicon

Oxide

Photo resist

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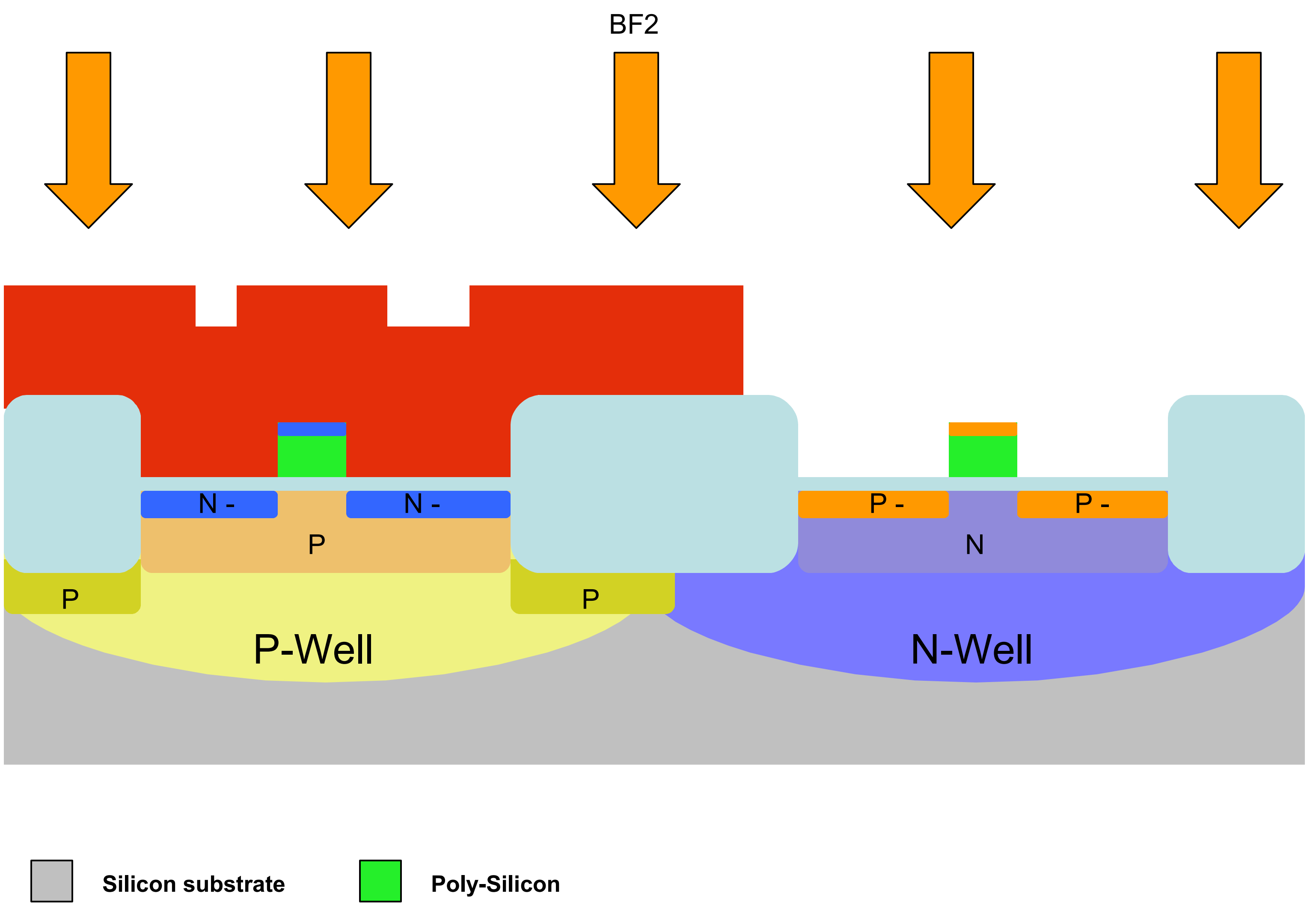
2005

PMOS LDD Implant



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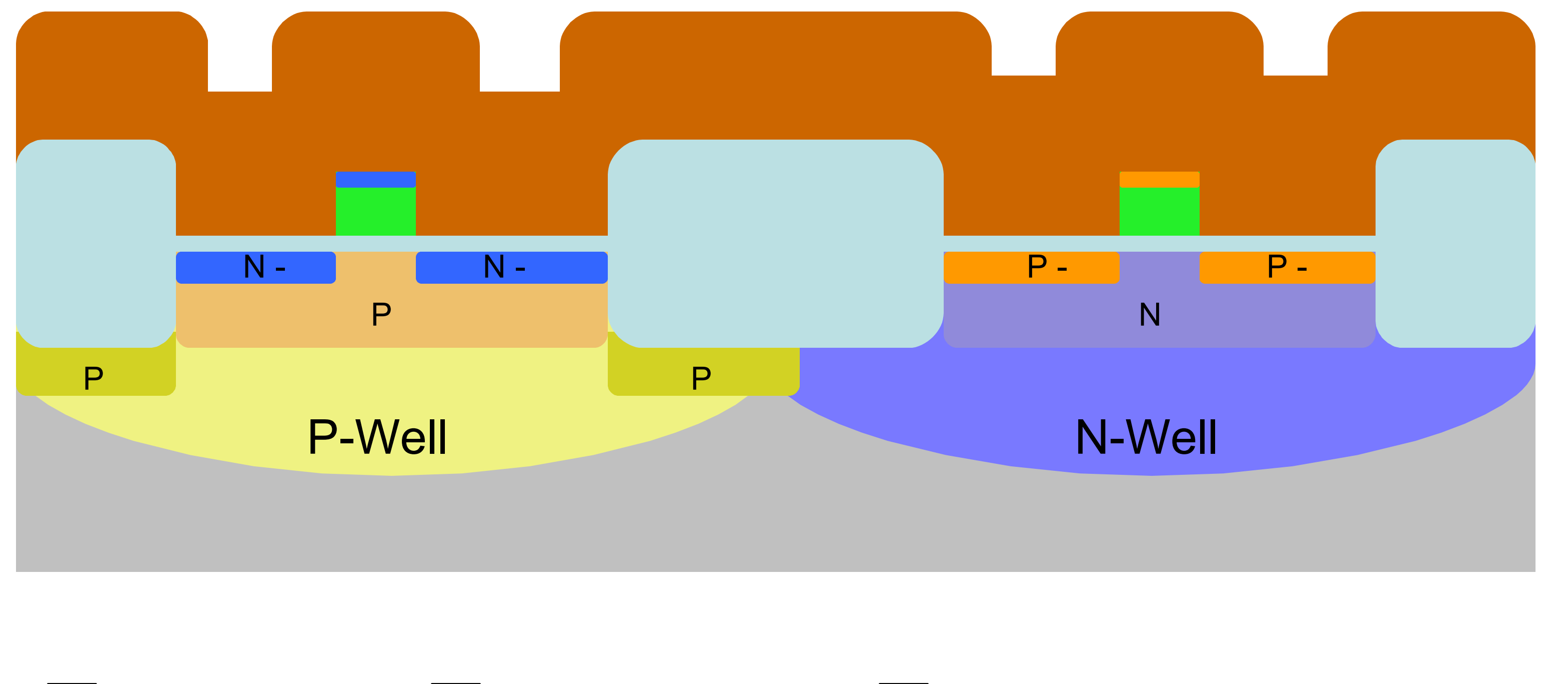
2005

LDD Spacer Deposition



Silicon substrate **Poly-Silicon** **TEOS = 4000A**

Oxide

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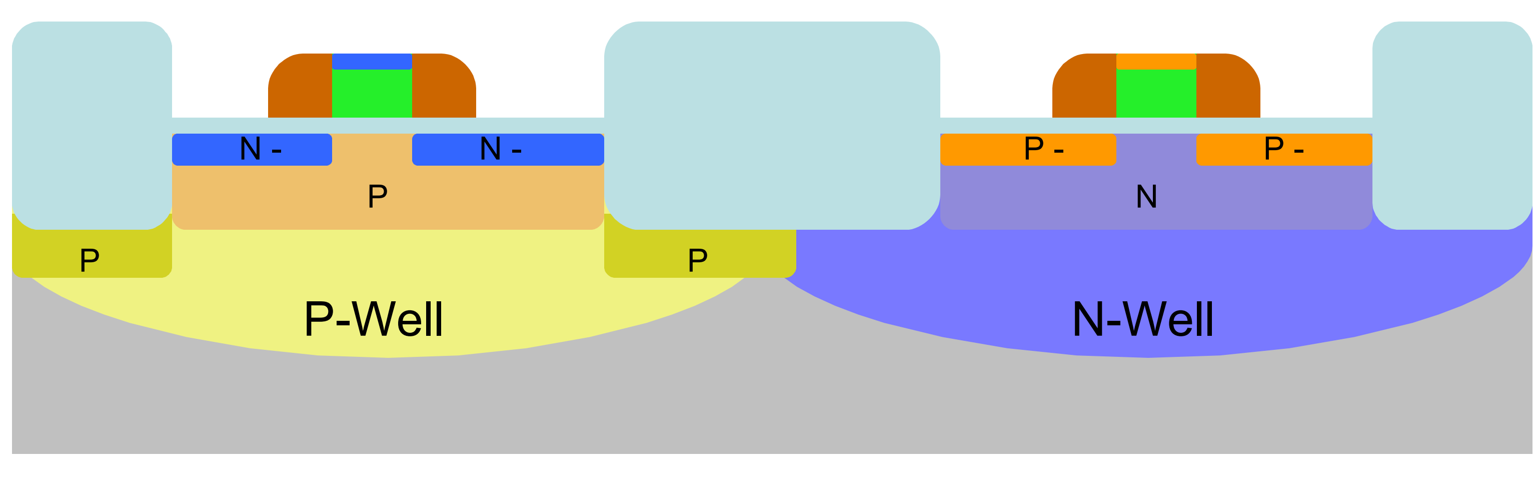
2005

LDD Spacer Formation

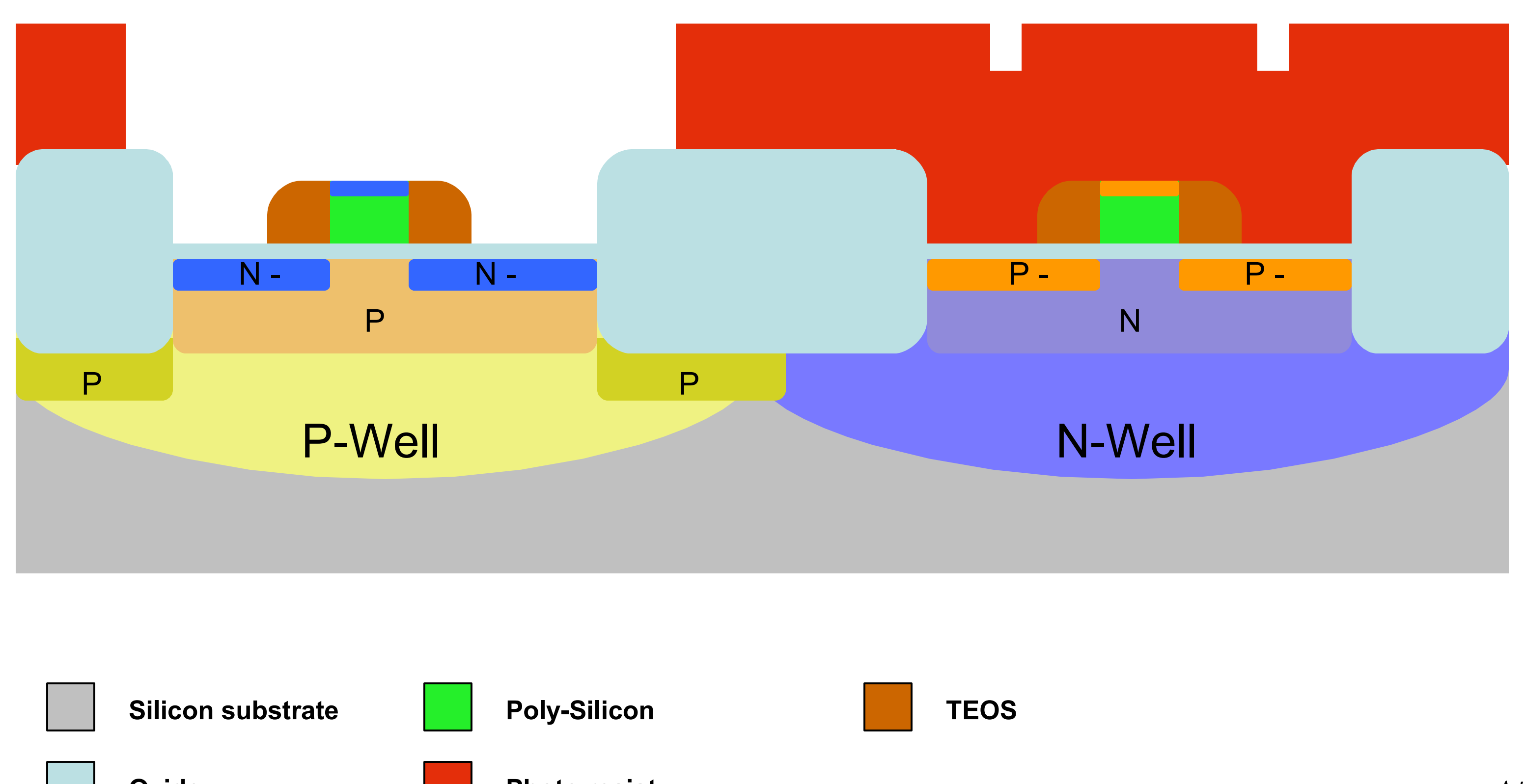


Silicon substrate **Poly-Silicon** **TEOS**

Oxide

Attila Horvath
2005

N+ S/D & Gate Photo



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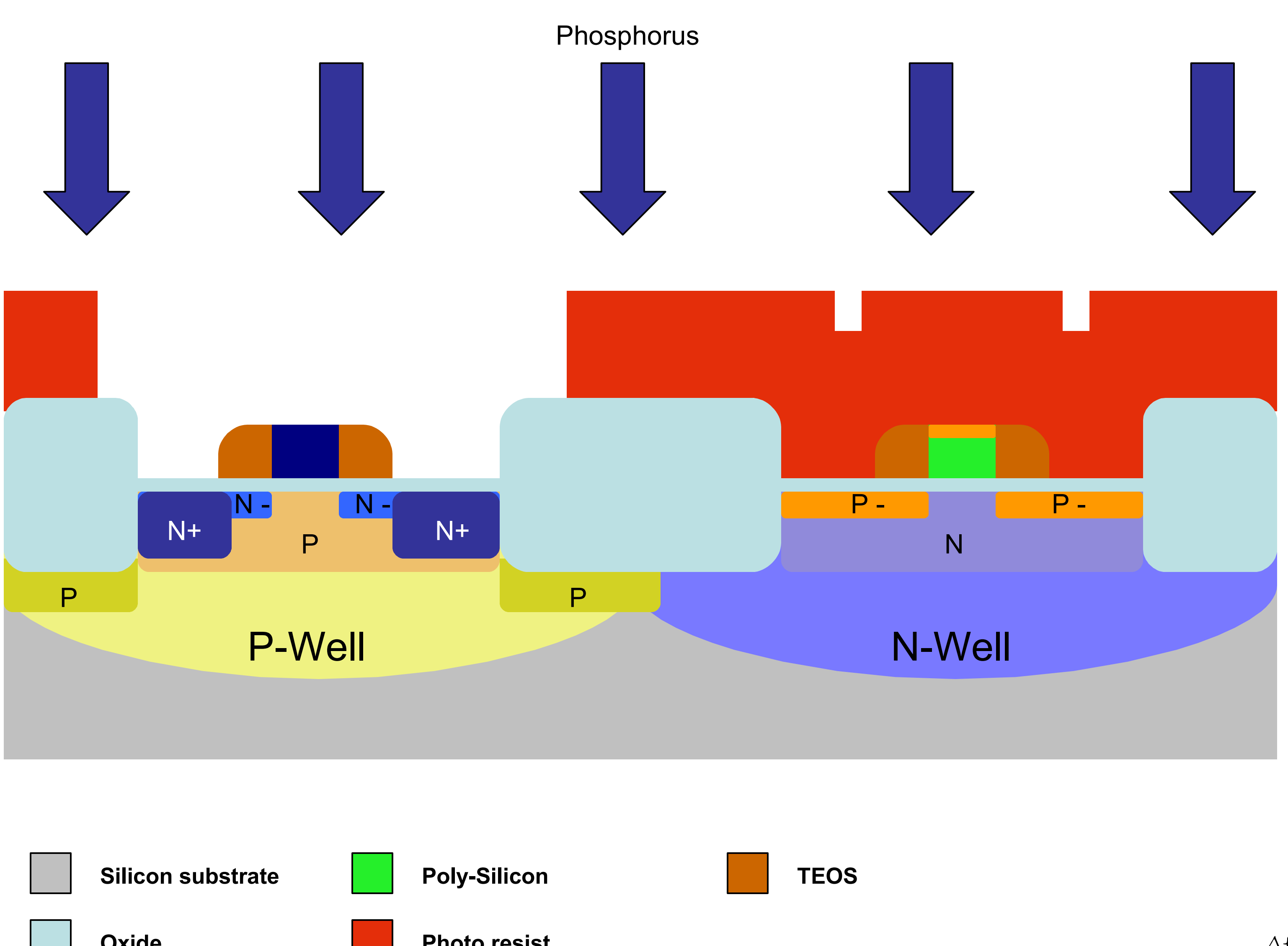
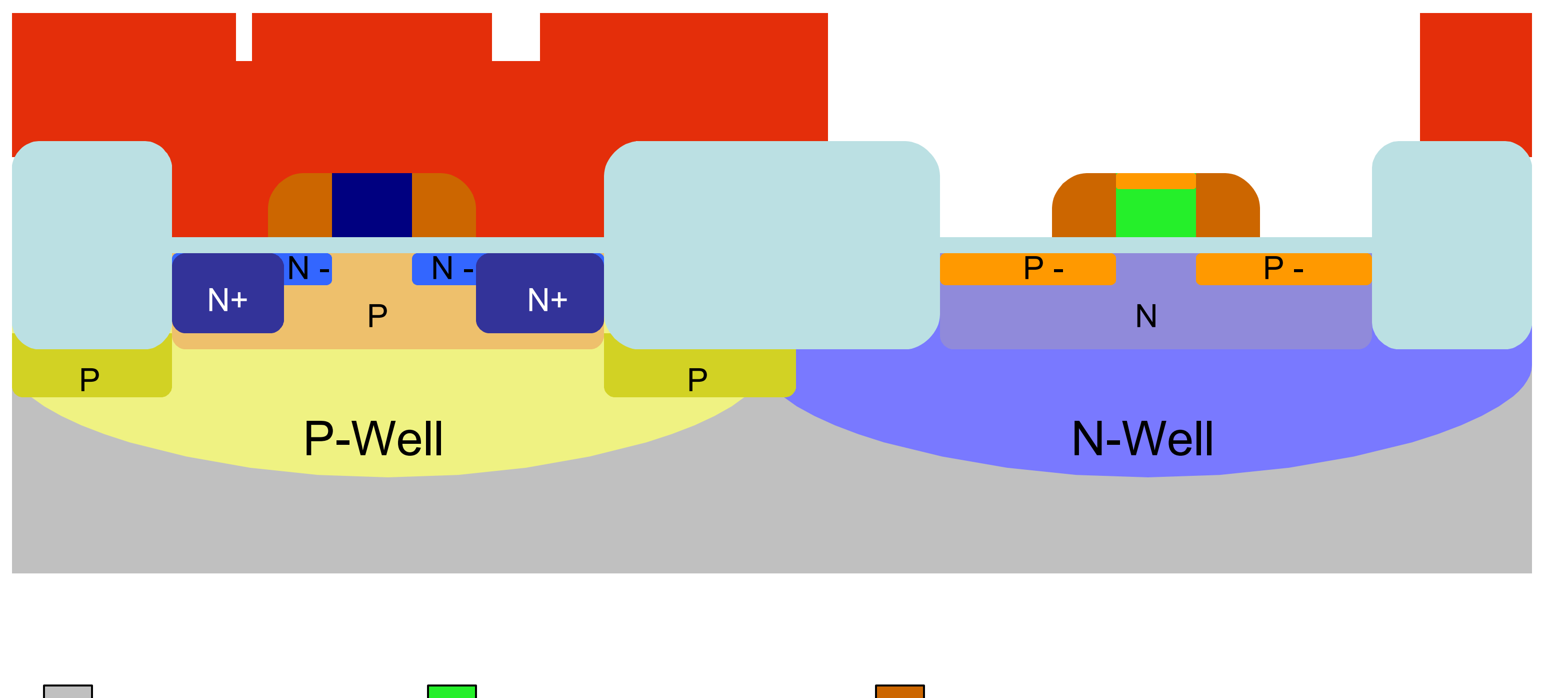
2005

N+ S/D & Gate Implant



Attila Horvath
2005

P+ S/D & Gate Photo



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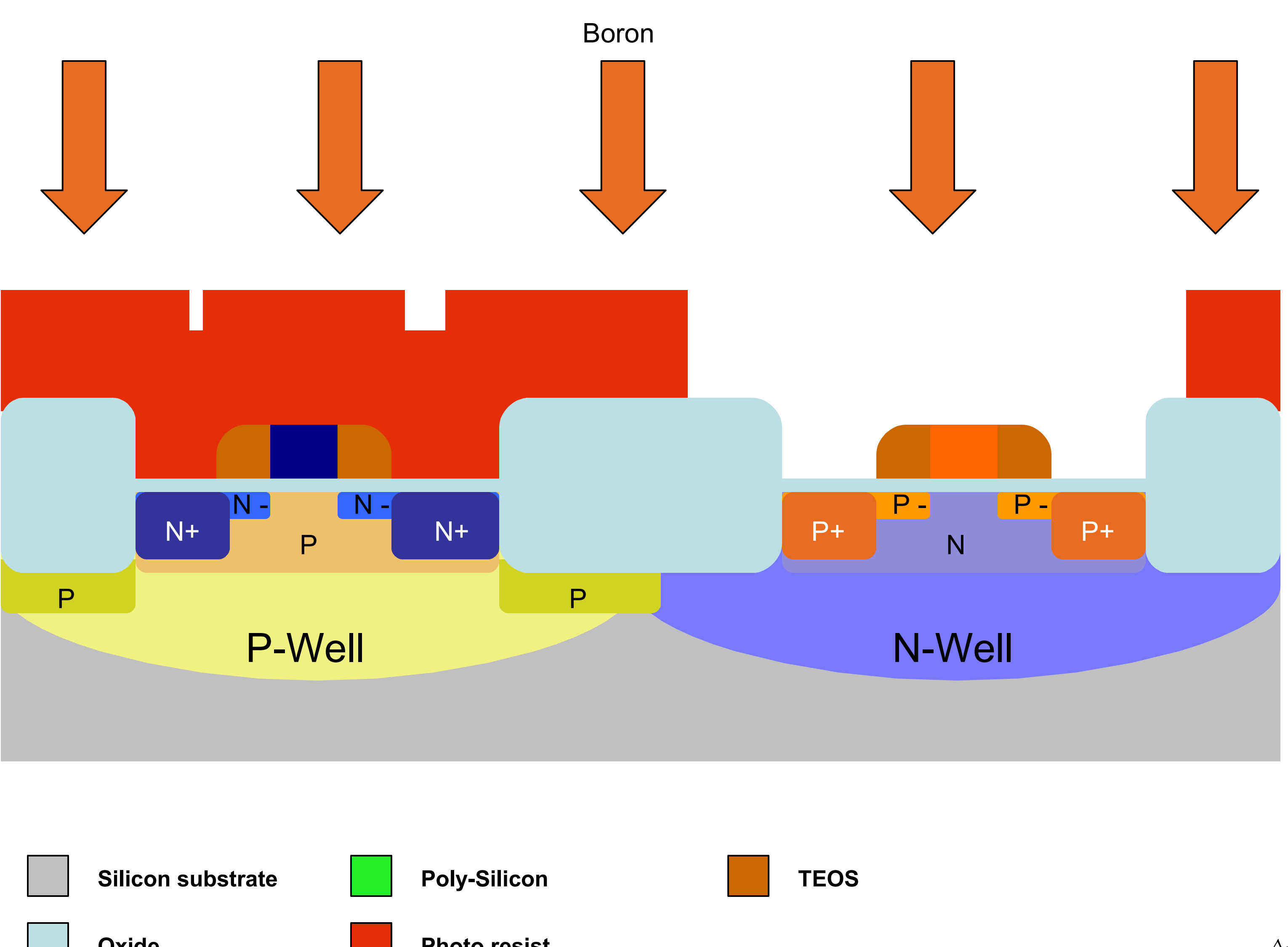
2005

P+ S/D & Gate Implant



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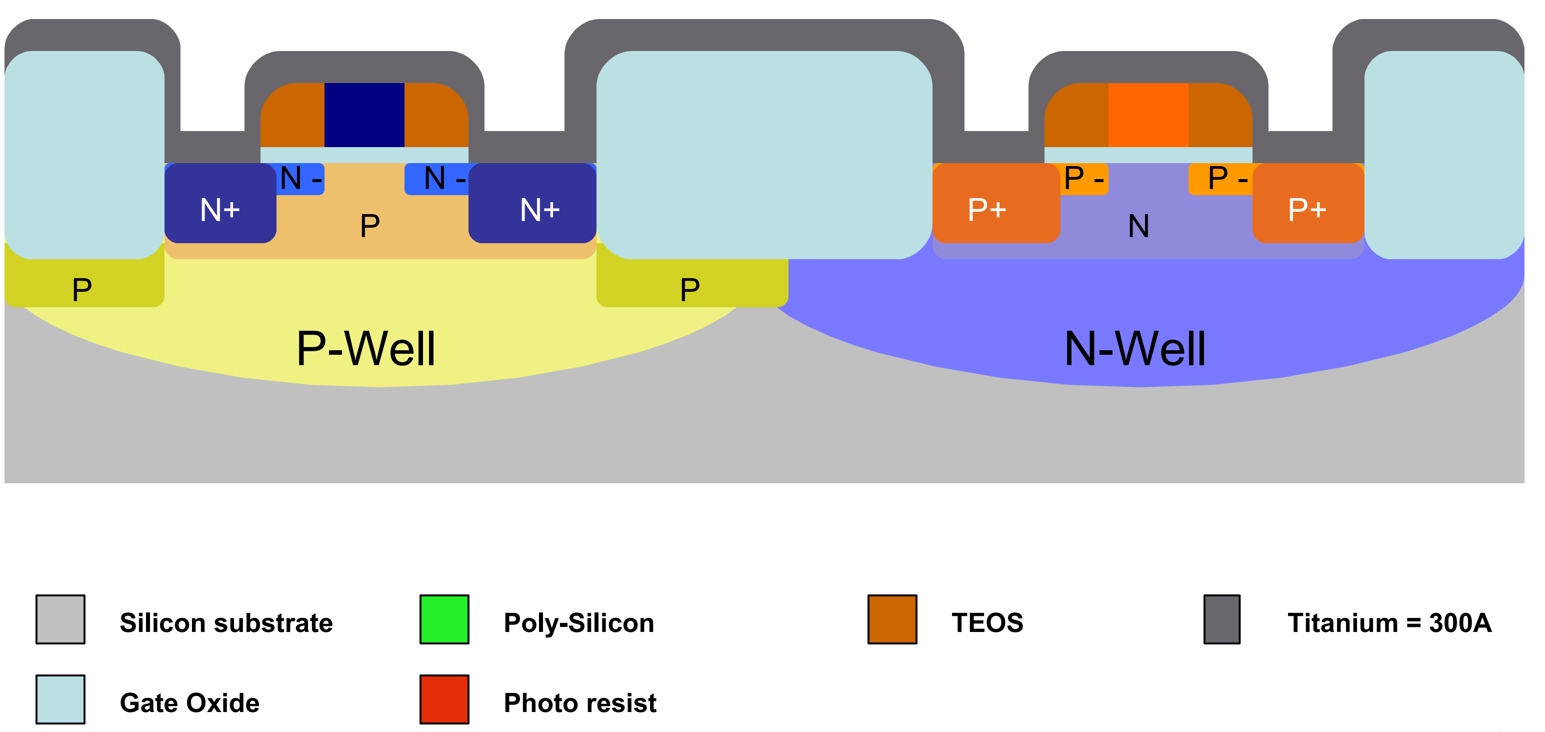
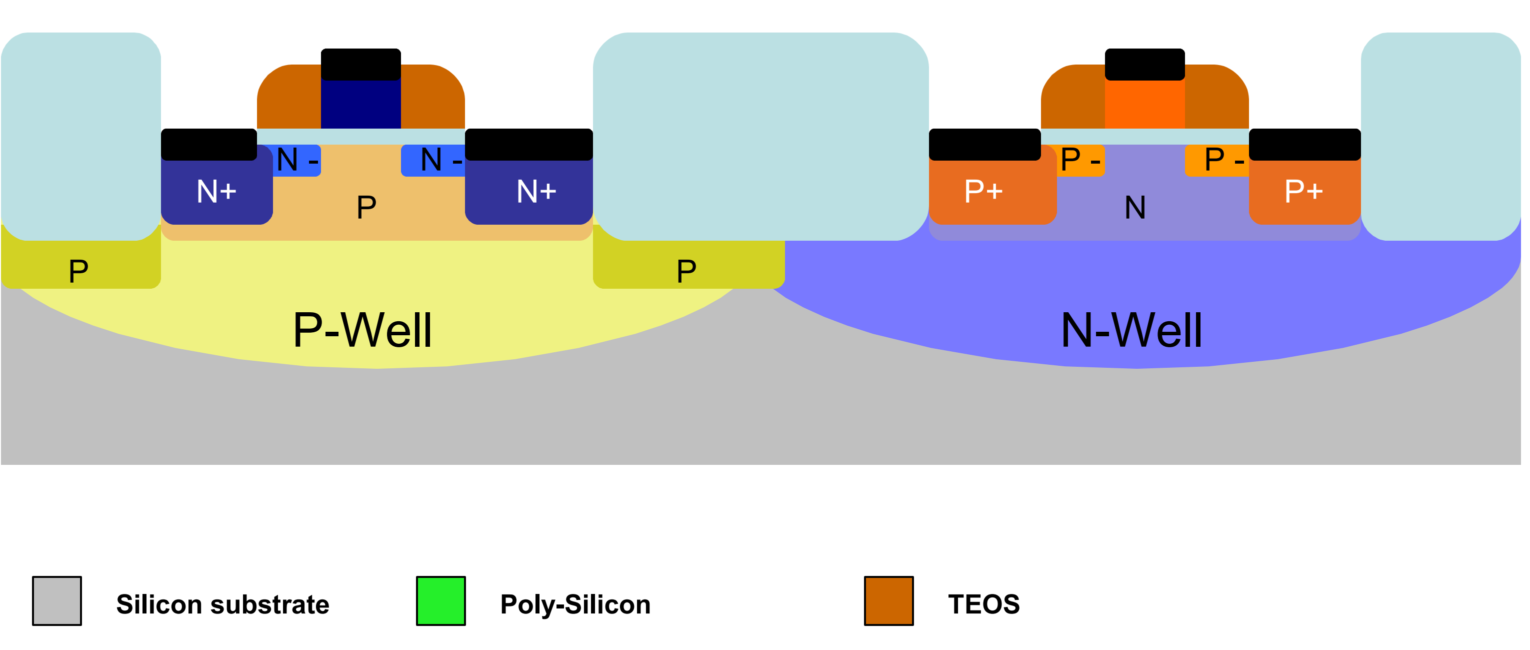
2005

Titanium Deposition



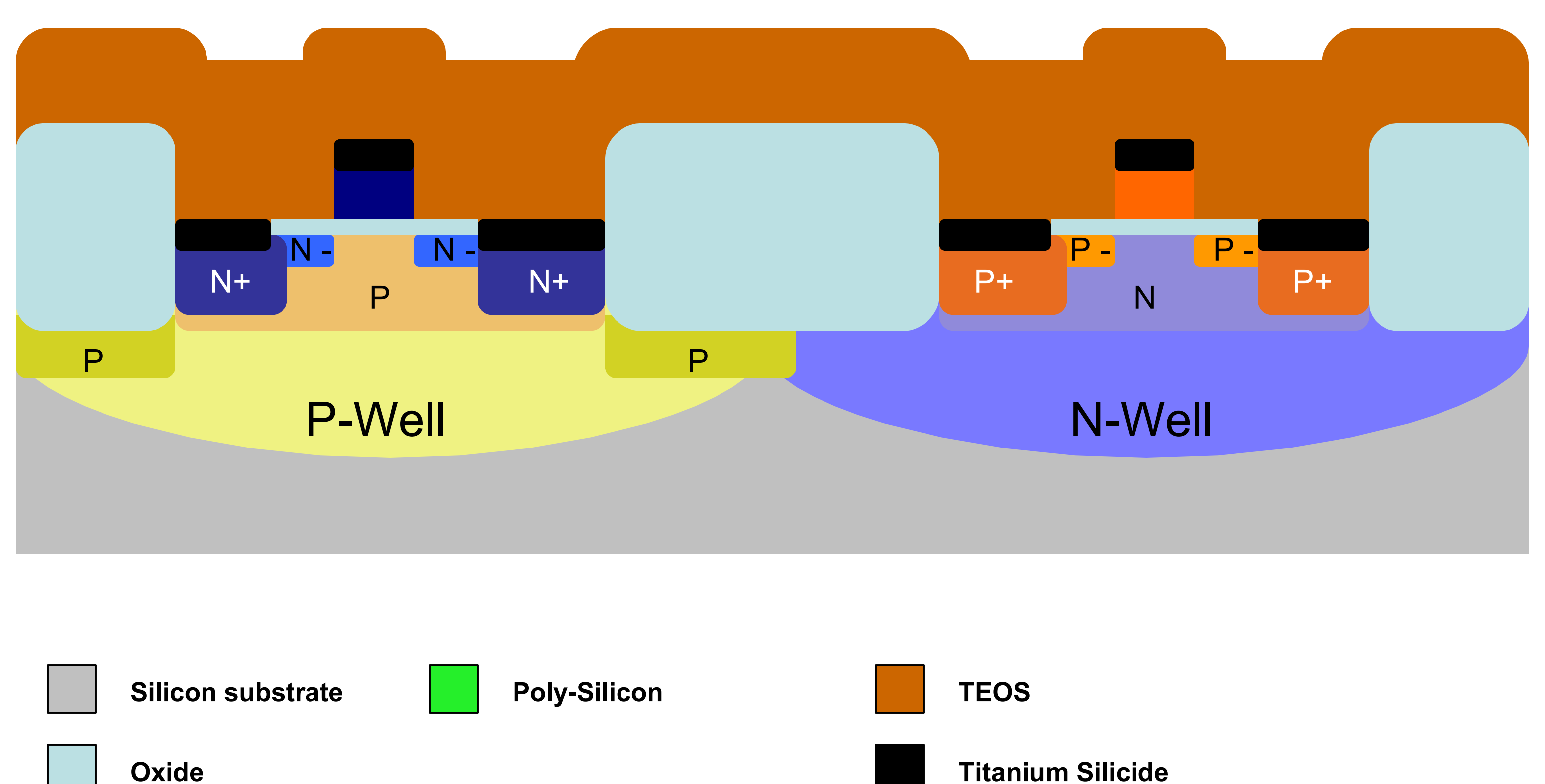
Attila Horvath 2005

Titanium Silicide formation



Attila Horvath 2005

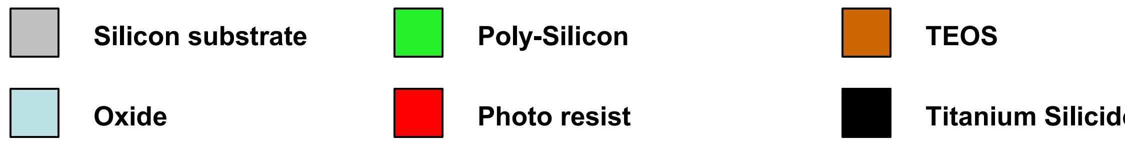
TEOS Deposition



Attila Horvath 2005

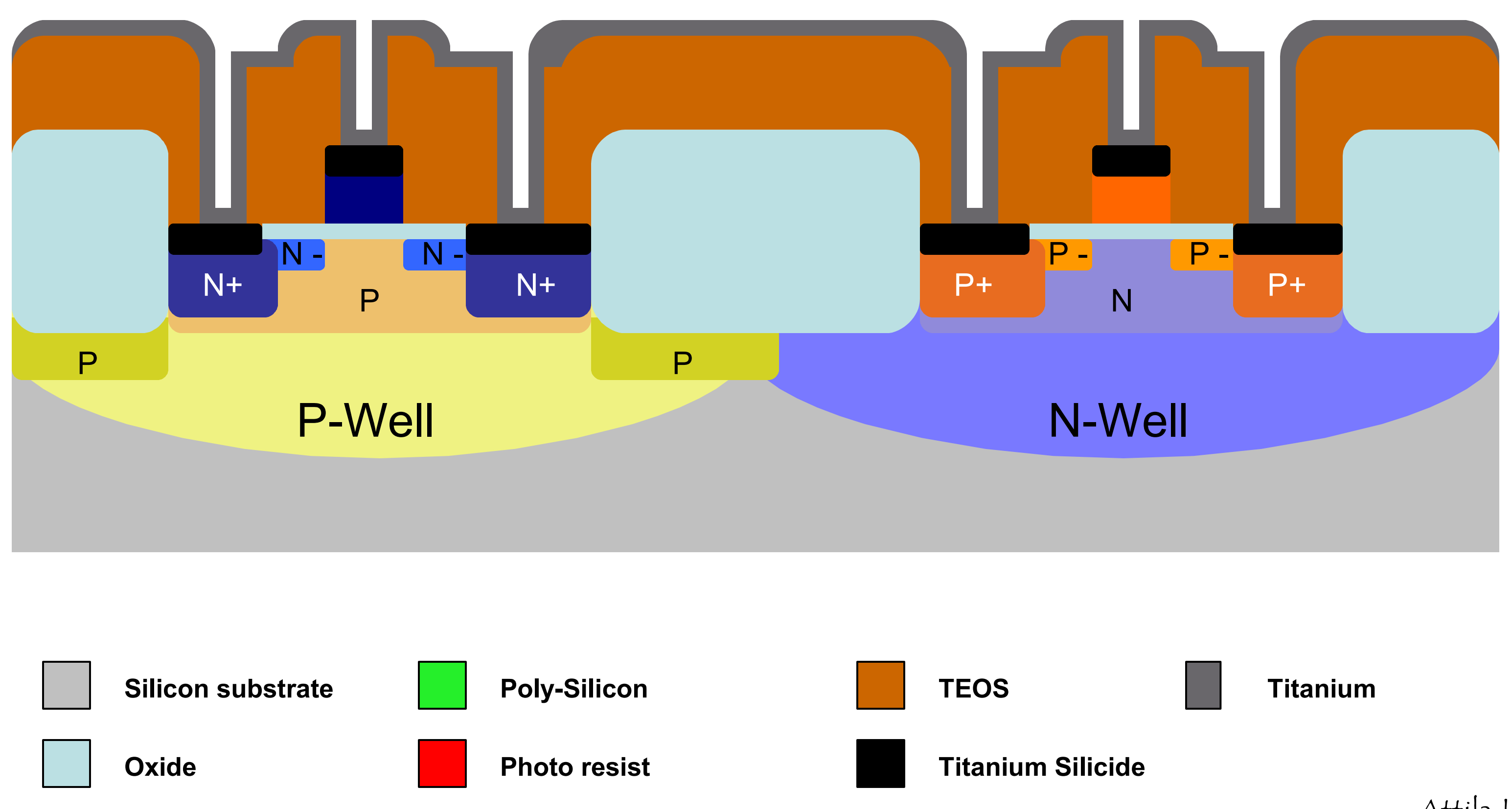
Contact Photo and Etch

N - N -
N+ P N+
P P-Well P
P - P -
P+ N P+
N-Well



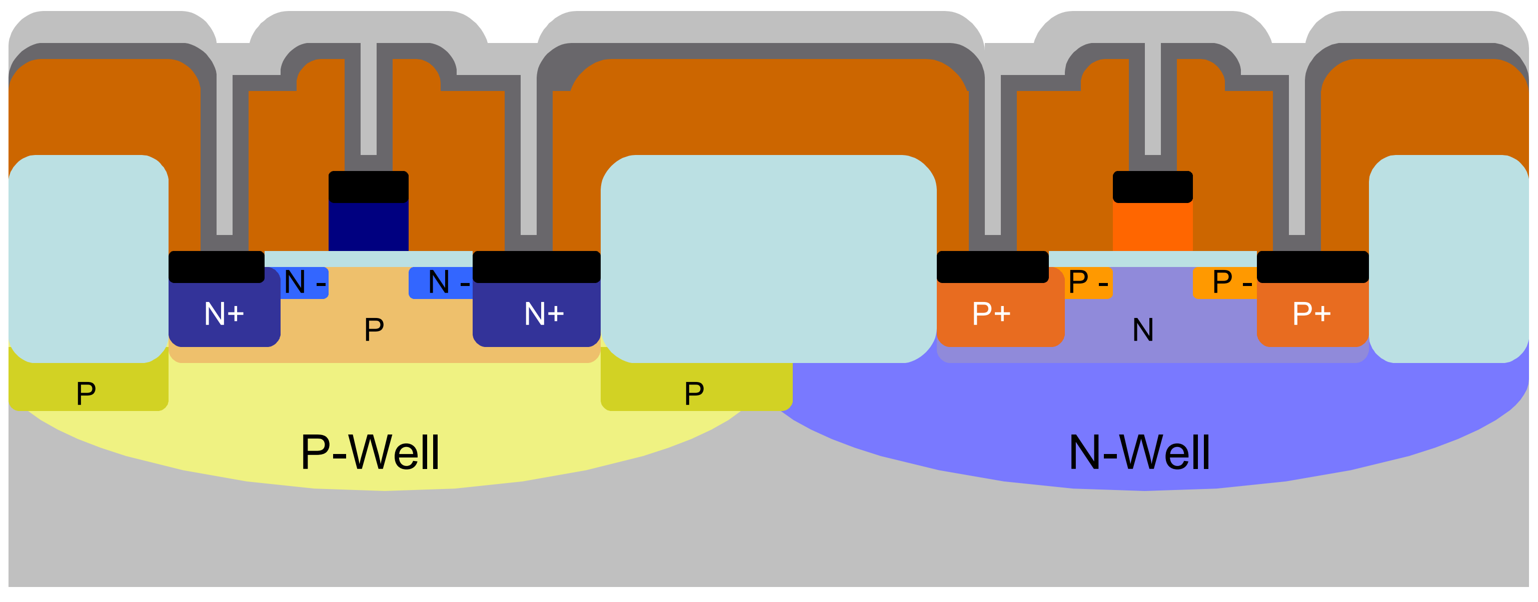
Attila Horvath 2005

Titanium Liner Deposition



Attila Horvath 2005

Aluminum Deposition

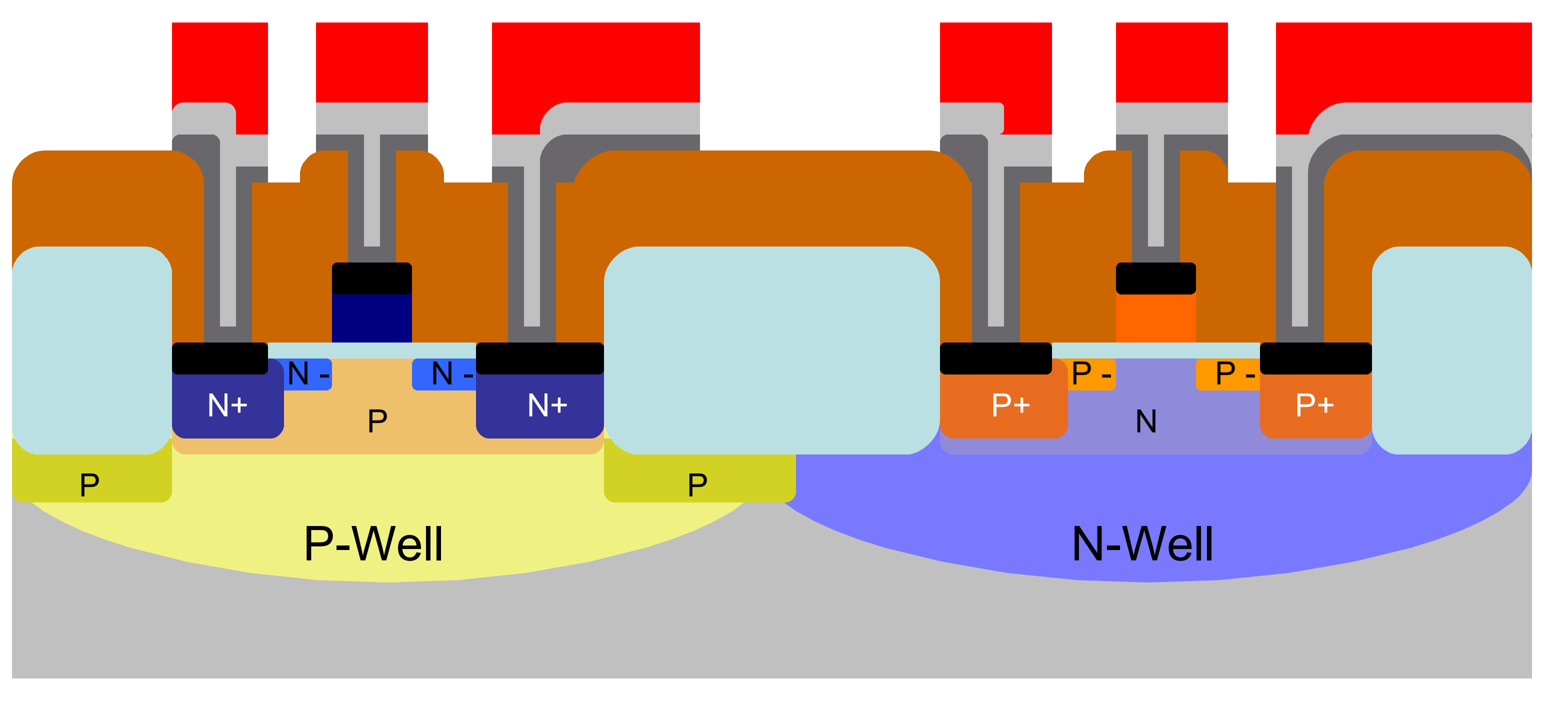


Silicon substrate | Poly-Silicon | TEOS | Titanium

Oxide | Photo resist | Titanium Silicide | Aluminum

Attila Horvath
2005

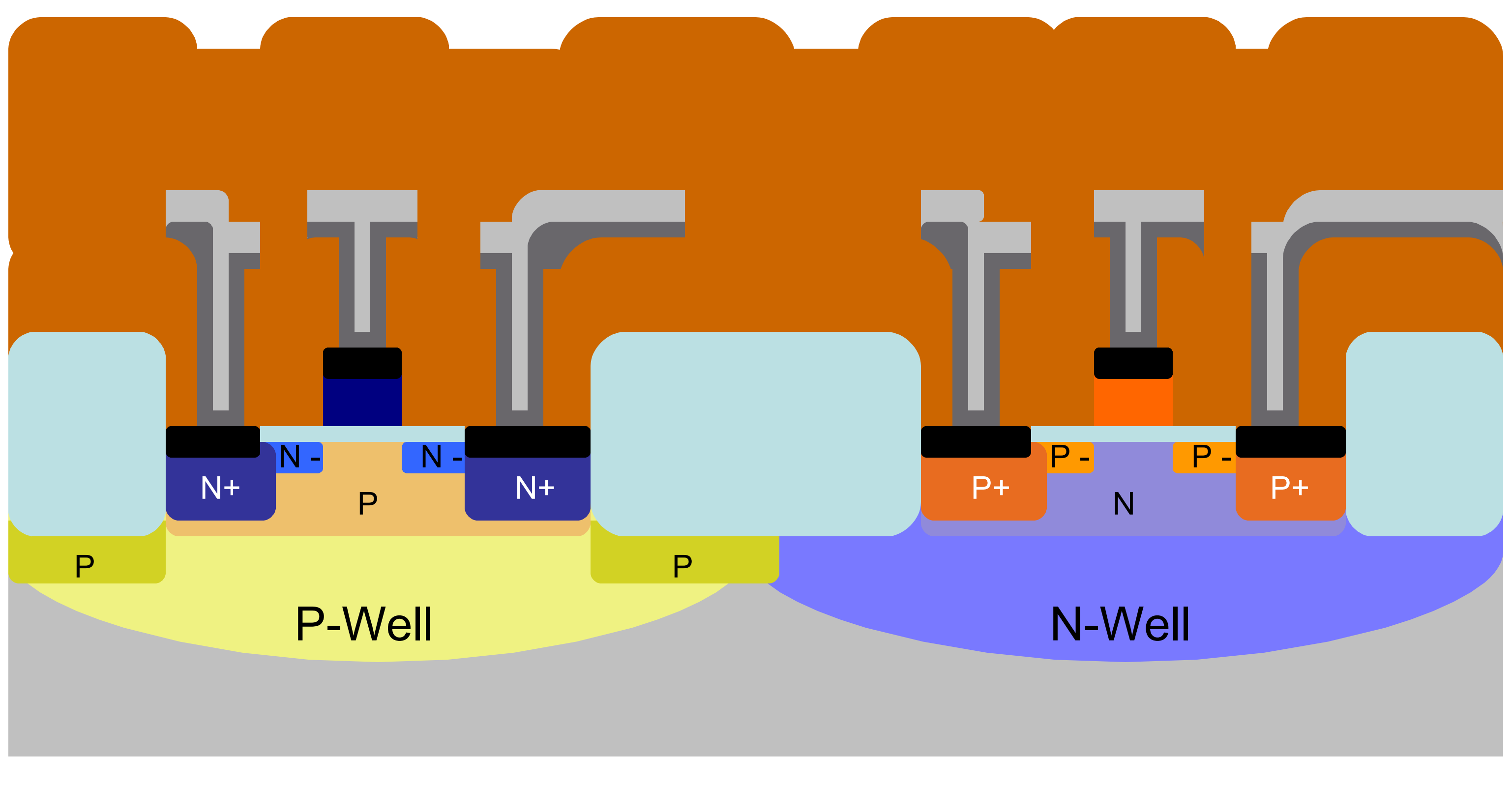
Metal 1 Photo and Etch



Silicon substrate	**Poly-Silicon**	**TEOS**	**Titanium**
Oxide	**Photo resist**	**Titanium Silicide**	**Aluminum**

Attila Horvath
2005

TEOS Deposition



Silicon substrate

Poly-Silicon

TEOS

Titanium

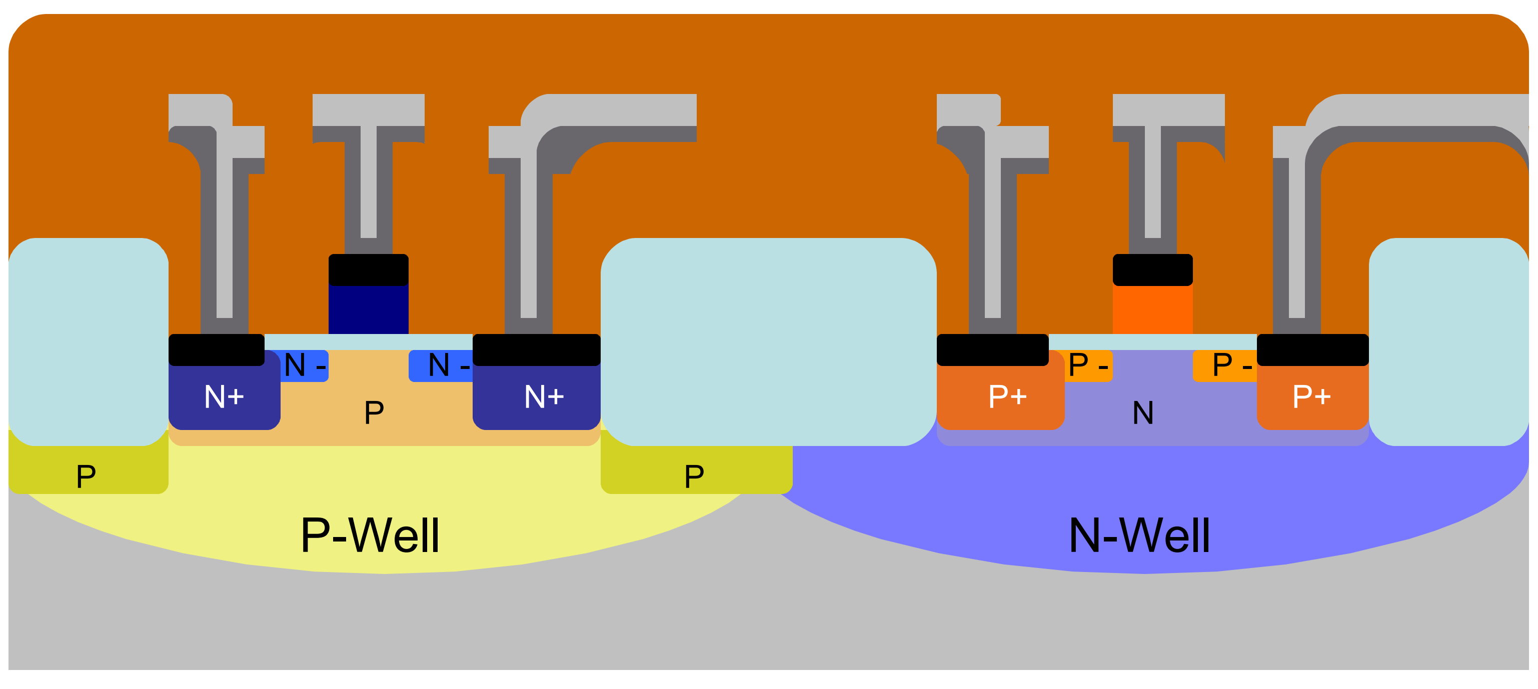
Gate Oxide

Titanium Silicide

Aluminum

Attila Horvath
2005

CMP Planarization

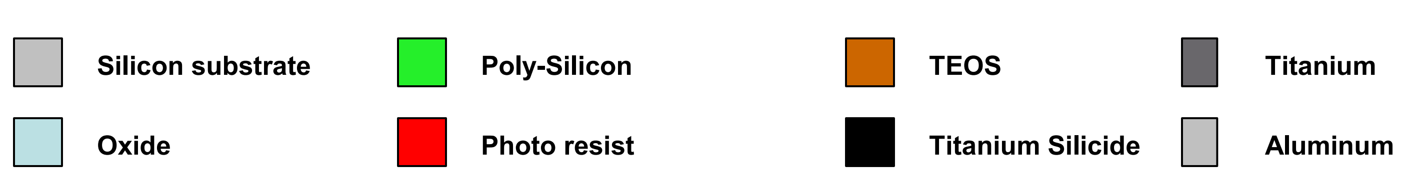


Silicon substrate	Poly-Silicon	TEOS	Titanium
Oxide		Titanium Silicide	Aluminum

Attila Horvath
2005

Via 1 Photo and Etch

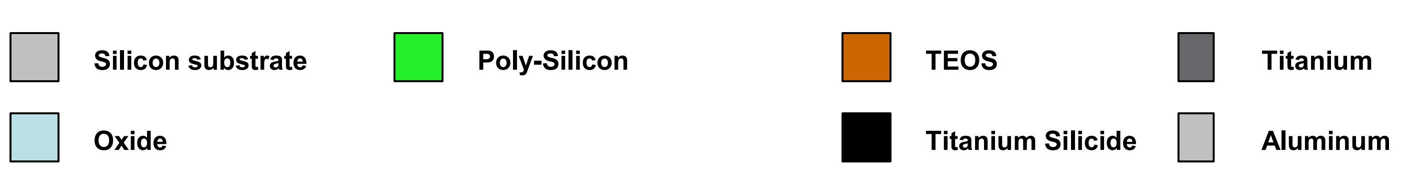
N -
N -
N+
P
N+
P -
P -
P+
N
P+
P
P
P-Well
N-Well



Attila Horvath
2005

Aluminum Deposition

N+
N -
P
N -
N+
P
P-Well
P
P+
P -
N
P -
P+
N-Well



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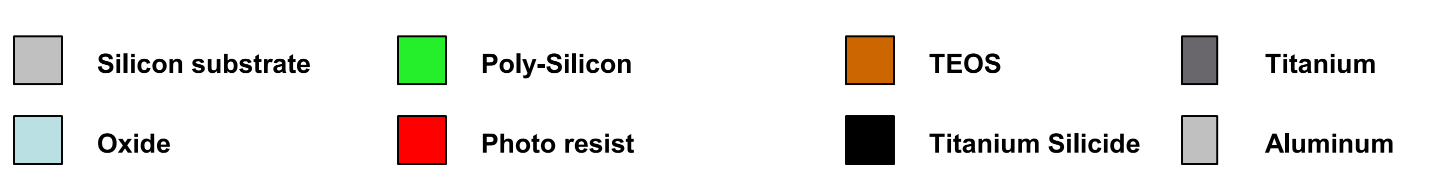
2005

Metal 2 Photo and Etch

N - N -
N+ P N+
P P
P-Well

P - P -
P+ N P+
N-Well



Attila Horvath
2005

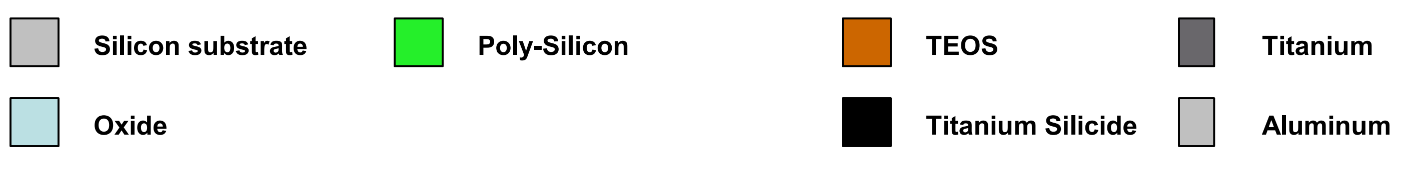
TEOS Deposition and Planarization

N+ N - P N - N+

P+ P - N P - P+

P P

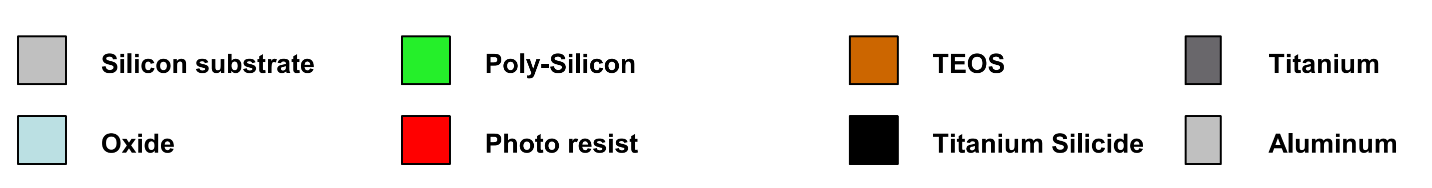
P-Well N-Well



Attila Horvath
2005

Via 2 Photo and Etch

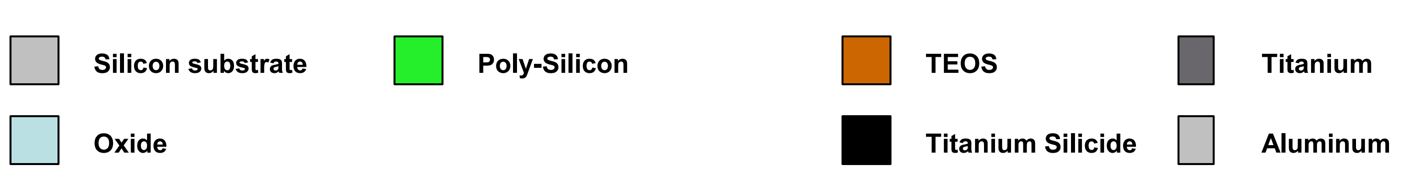
N -
N -
N+
P
N+
P -
P -
P+
N
P+
P
P
P-Well
N-Well



Attila Horvath
2005

Aluminum Deposition

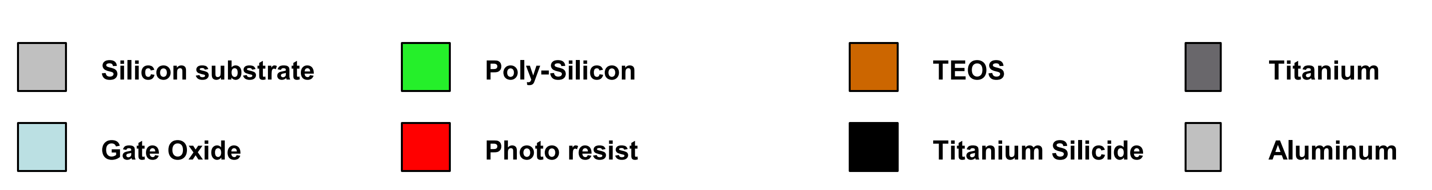
N -
N -
N+
P
N+
P -
P -
P+
N
P+
P
P
P-Well
N-Well



Attila Horvath
2005

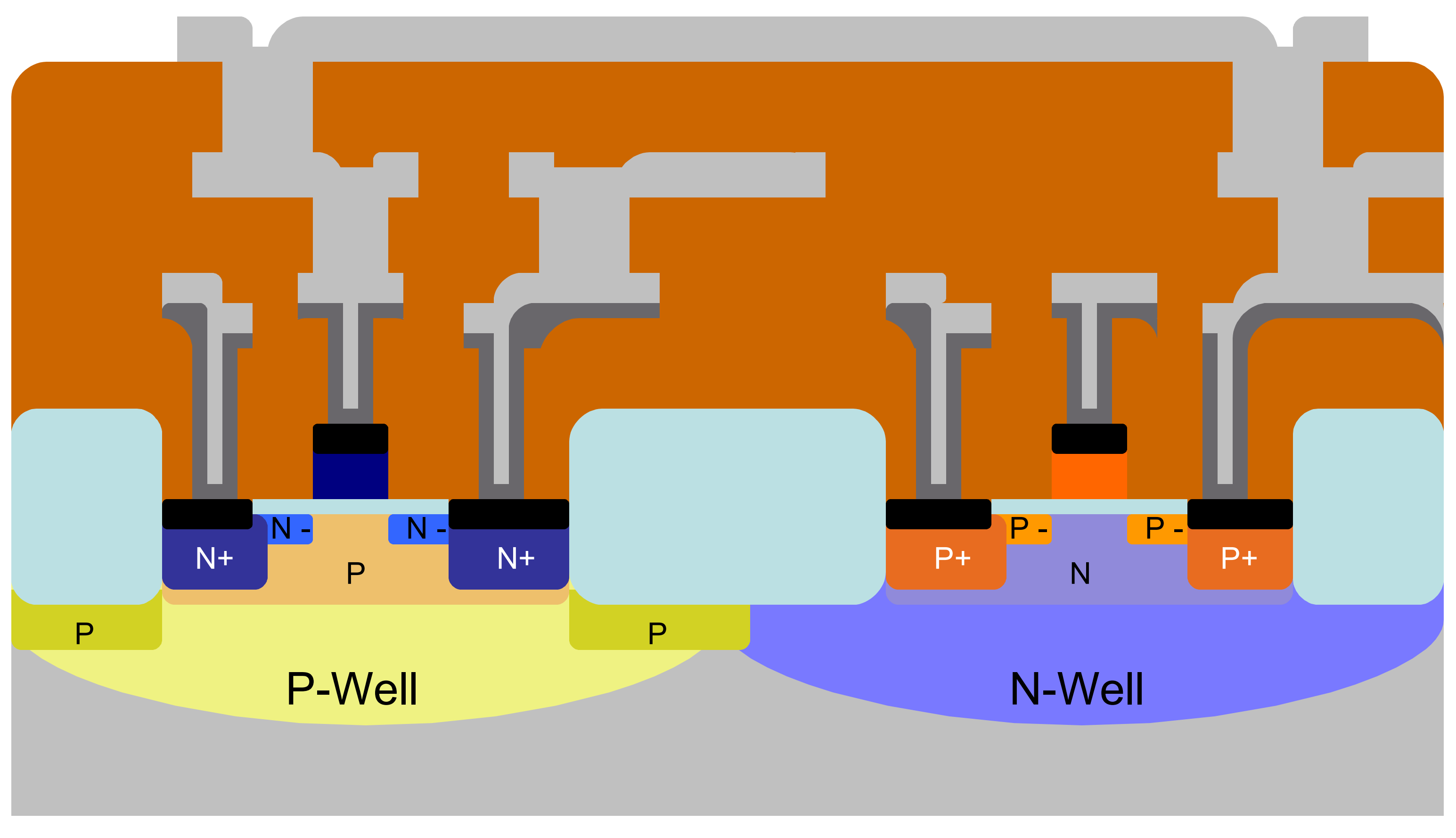
Metal 3 Photo and Etch

N - N -
N+ P N+
P - P -
P+ N P+
P P
P-Well N-Well



Attila Horvath
2005

Complete CMOS Device



Silicon substrate

Poly-Silicon = 2500A

TEOS

Titanium

Gate Oxide = 80A

Titanium Silicide

Aluminum

Attila Horvath
2005