Phosphorus-diffused LPCVD Polysilicon Passivated Contacts via Low Pressure Oxidation

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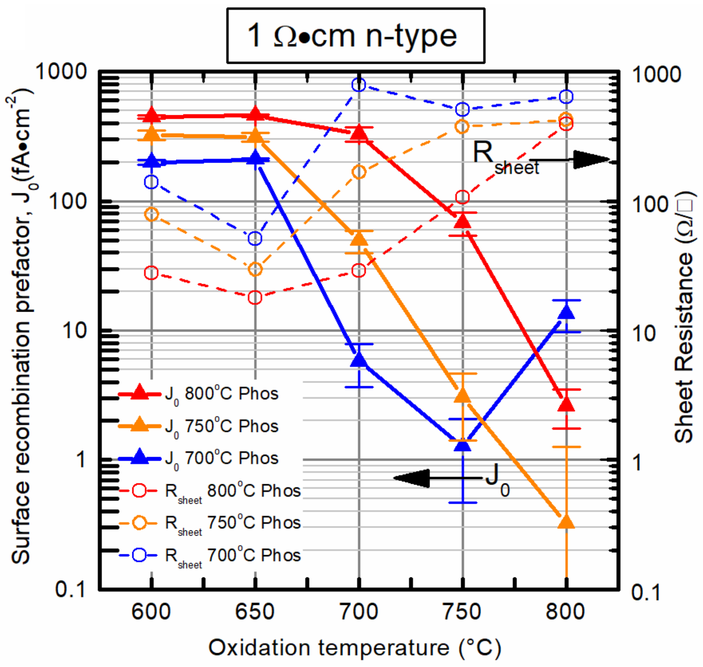
- **Phosphorus-diffused Poly-Ox** passivated contact, via **LPCVD with in-situ low pressure oxidation**.
- Lowest measured **J_0 = 0.3 fA·cm^{-2}**, with excellent passivation on both 1 and 100 Ω·cm wafers.
- Lowest measured **ρ_c < 1 mΩ·cm^2**, below measurement limit of method used.

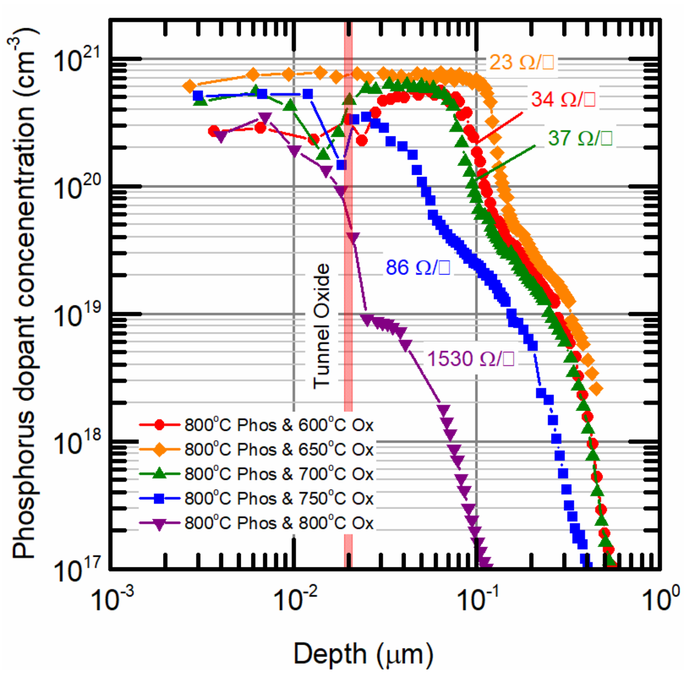
1. J_0 and R_{sheet}

- Lowest J_0 was **0.3 ± 0.8 fA·cm^{-2} on 1 Ω·cm** wafer, and **3.7 ± 0.2 fA·cm^{-2} on 100 Ω·cm** wafer.
- Strong correlation is observed between low J_0 and high R_{sheet}.
- Condition for excellent J_0 is broad, and is achieved for a wide range of conditions.
- Lifetime samples measured **implied-V_{OC} > 735 mV**, with bulk lifetimes > 70 ms on 100 Ω·cm wafer.



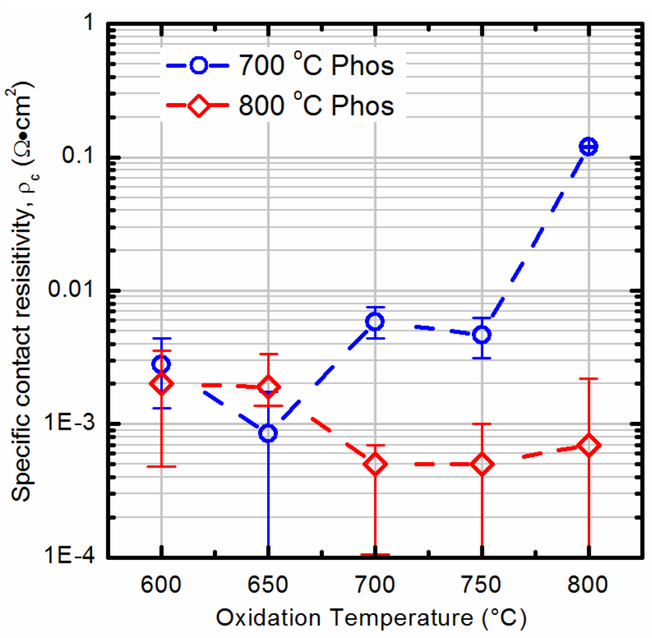
2. Doping profiles

- Strong influence of oxide thickness to the doping profile.
- **Minimizing dopant penetration** into Si appears paramount for low J_0.
- Modelling indicates high J_0 for low R_{sheet} samples are due to additional recombination in the diffused region.



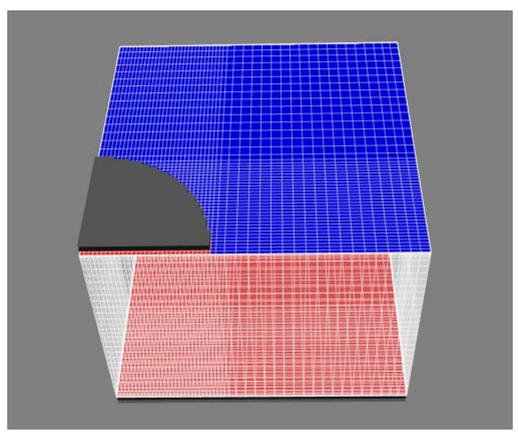
Oxide Temp	Measured J_0	Measured R_{sheet} (PCD)	Modelled J_0 (U_{Auger} and U_{surf} only)	Modelled R_{sheet} (ECV profile in Si bulk)
(°C)	(fA·cm^{-2})	(Ω·□)	(fA·cm^{-2})	(Ω·□)
600	357	29	38	34
650	355	19	15	23
700	345	31	30	37
750	123	75	21	86
800	4.6	509	0.3	1530

3. Contact Resistivity



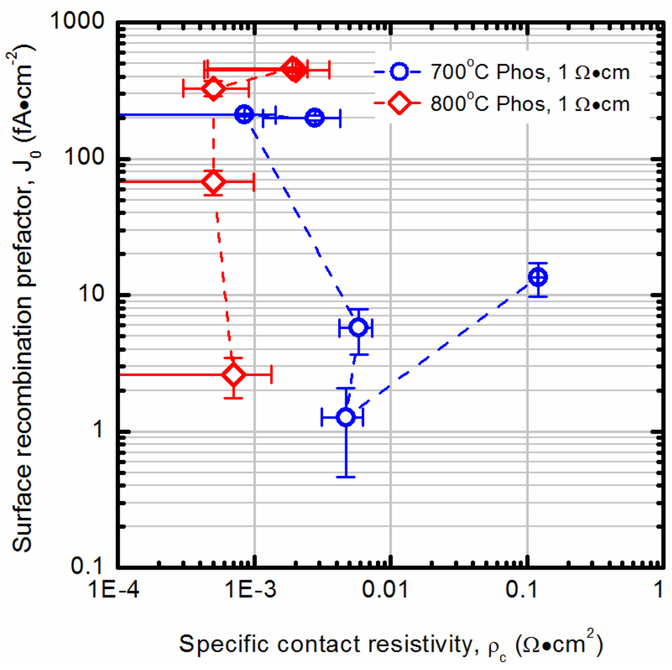
- **ρ_c of < 1 mΩ·cm^2** is achieved for a wide range of conditions.
- **ρ_c** is often below measurement limit of the method.

Measured using modified Cox and Strack (C&S) structure and fitted to Quokka 3D ohmic simulations to deduce ρ_c.



4. Conclusion

- Excellent J_0 and ρ_c is achieved simultaneously **J_0 < 3 fA·cm^2** and **ρ_c < 1 mΩ·cm^2**.
- Oxide thickness is crucial to control phosphorus diffusion.
- Low J_0 values are achieved with minimal diffusion into the Si bulk.



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