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APPLICATION NOTE

200 mm <100> PREFERRED FLOAT ZONE (PFZ) SILICON WAFERS

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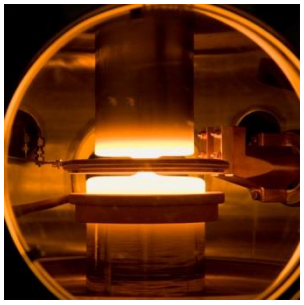

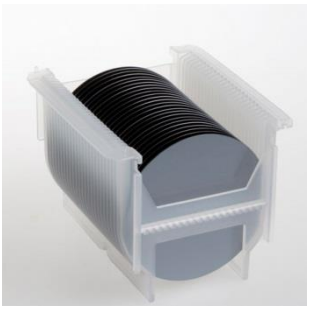

Abstract
It is demonstrated that gas doped Preferred Float Zone 200 mm wafers have excellent resistivity uniformity and that the resistivity stability after high temperature processing is very well controlled.

Introduction
Topsil has a well-established history in supplying neutron transmutation doped (NTD) float zone (FZ) silicon wafers for the very high and high power electronic market. The NTD product has been carefully designed in order to meet the market requirements of extremely high resistivity uniformity and stability upon subsequent wafer processing. Our standard capability covers the resistivity range 20-1500 Ω-cm for 2-5 inch and the resistivity range 20-800 Ω-cm for 150mm and 200mm <100>.

This product application note covers a gas doped 200mm <100> product in the resistivity range 10-100 Ω-cm with equally high capability in terms of resistivity uniformity and stability. This product, however, has some distinct features which require clarification in order for the customer to appreciate the product properties. The scope of this application note is to describe the capability and material properties of this product.

Product properties
The product has tight resistivity control with deviations from target resistivity less than 10%, radial resistivity variation (RRV) less than 14%, and striations less than 12%. The product resistivity also shows excellent thermal stability after processing. The point defect properties are carefully designed, and contamination is carefully controlled to give a high GOI yield, above 95% and wafer lifetimes above 500 µs.

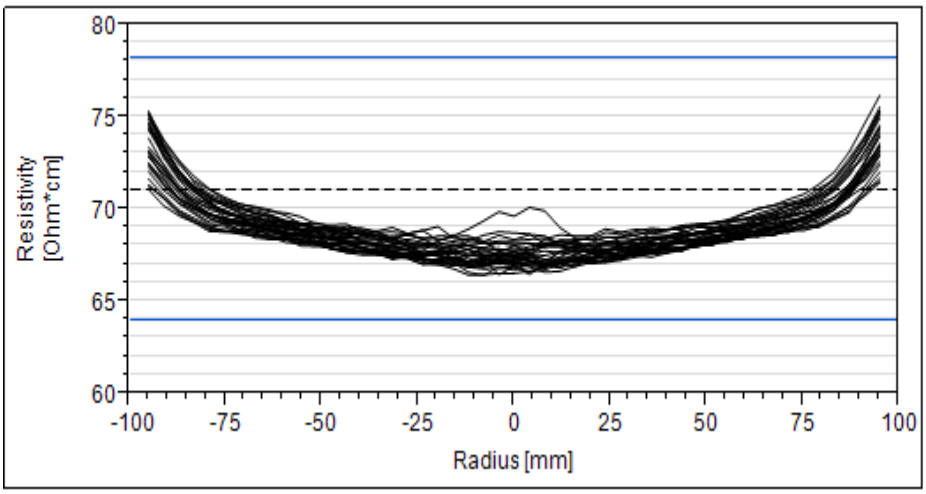

Figure 1. Typical wafer radial resistivity profile.

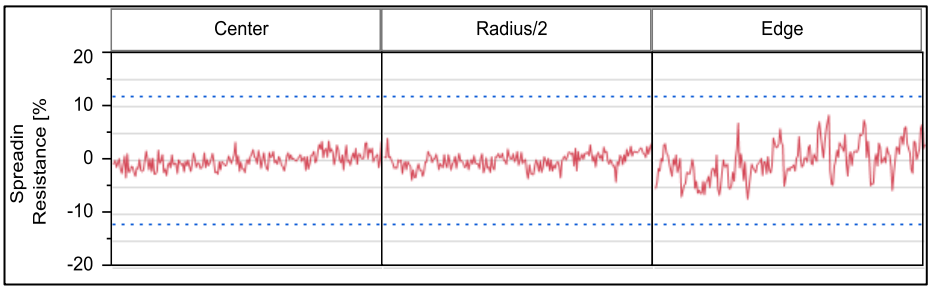

Figure 2. Typical striations

Product Design

Topsil has designed the process in such a way as to achieve a uniform and stable resistivity centred at the target resistivity specified by the customer. This procedure ensures that the resistivity after wafer processing is within specification.

The lifetime is guaranteed and the minimum value of 500 µs will be provided in the certificate of conformance supplied with the wafers.

In order to verify the behaviour of resistivity and lifetime, Topsil can provide running SPC charts of average resistivity, RRV, and life-time. Examples of such SPC charts are shown in Figure 3, 4 and 5.

The product resistivity capability after thermal processing is displayed in the table below:

Resistivity range	Tolerance	RRV
10-100 Ω-cm	±10%	<14%

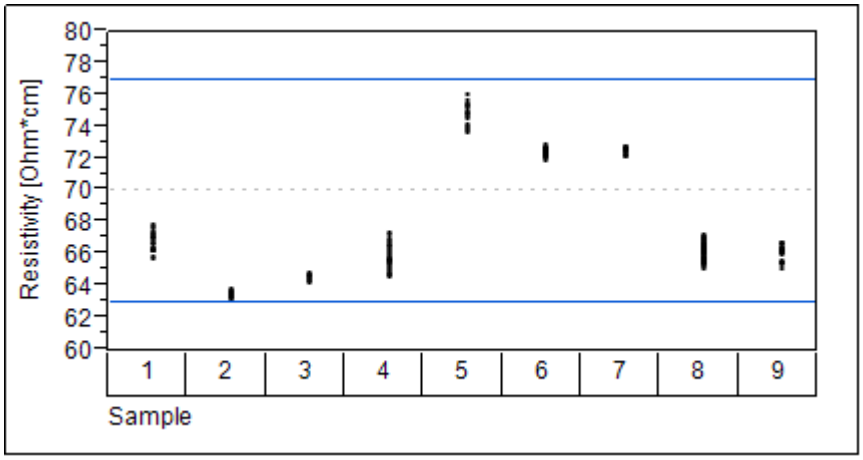

Figure 3. Control chart for resistivity for a 70 Ω-cm target ±10%. Measured according to a modified SEMI MF84 plan C.

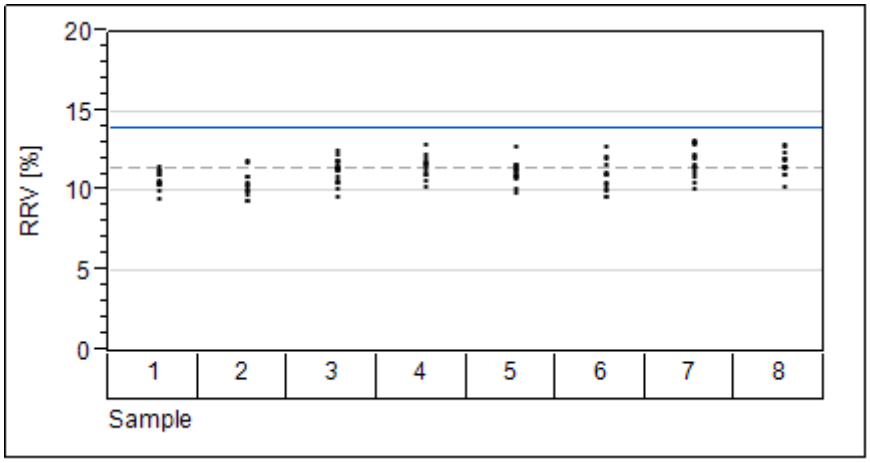

Figure 4. Control chart for radial resistivity variation. Upper specification limit 14%.

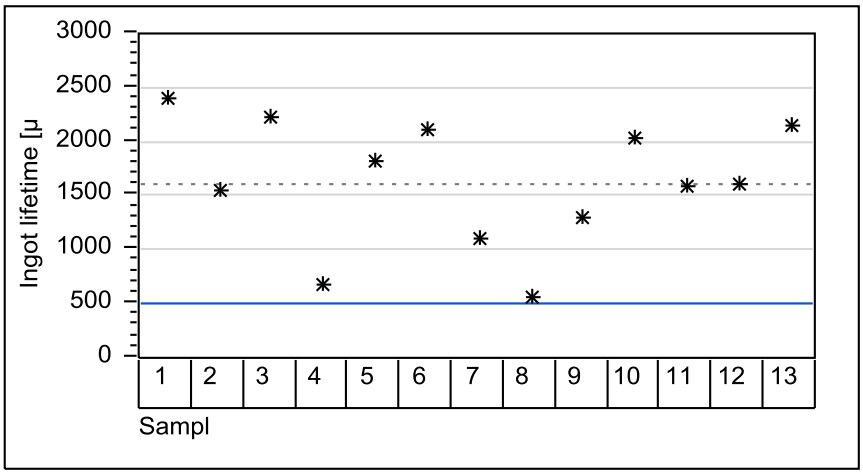

Figure 5. Control chart for ingot lifetime. Lower specification limit 500 µs.

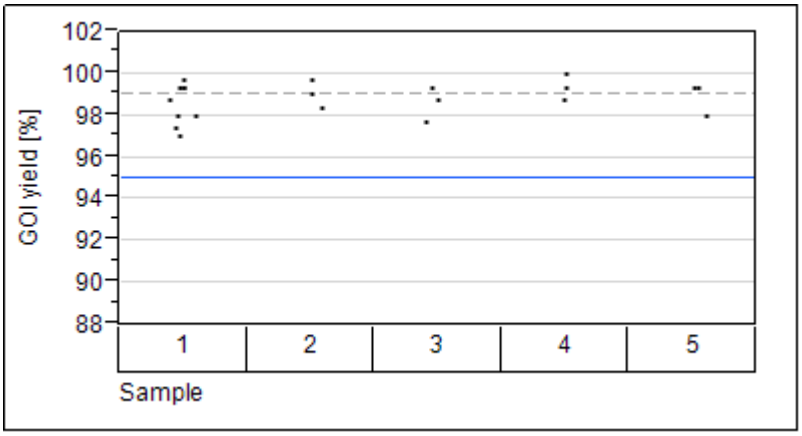

Figure 6. Control chart for GOI yield. Lower specification limit 95%.

Resistivity certification

The accept criteria for shipping wafers is that the resistivity from all wafers measured at radius/2 is within a narrowed costumer specification. The upper specification limit is lower by 9.2% and the lower specification limit is increased by 2.7%, corresponding to the maximum known deviation from the resistivity at radius half. The wafers are measured using a contactless RF technique. The resistivity from one point at radius half from all wafers will be provided in the certificate of analysis supplied with the wafers. An example of measurements at radius/2 compared to a line scan is shown in Figure 7.

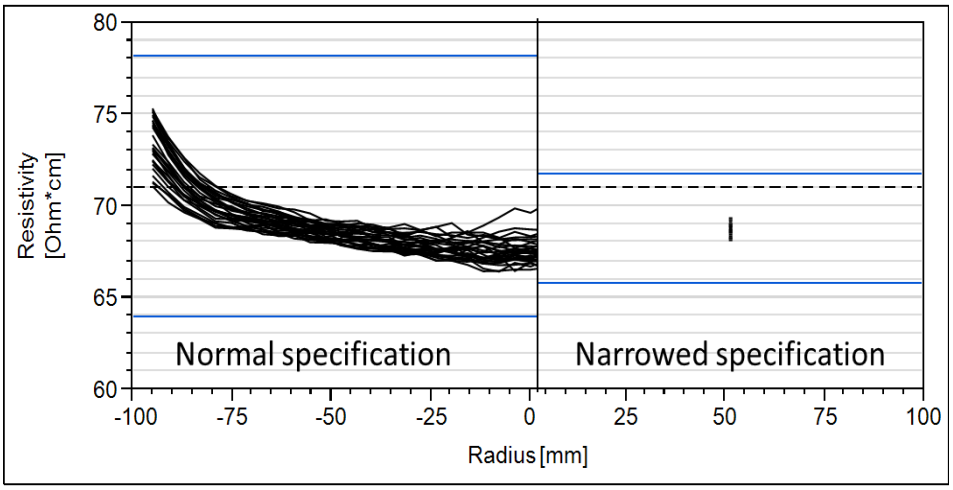

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Figure 7. Specification narrowing for 100% single point wafer resistivity measurement

Conclusion

This application note covers a gas doped 200 mm <100> product in the resistivity range 10-100 Ω-cm with excellent resistivity control and resistivity uniformity.

Topsil Semiconductor Materials A/S

Topsil is a world leading supplier of ultrapure silicon to the global semiconductor industry. Engaging in long term relations with customers, Topsil focuses on premium quality, an efficient production process and a safe delivery of products.

Topsil targets mainly the power market on which it provides ultrapure silicon for the most demanding purposes, based on extensive knowledge and significant investments in new technology, facilities and equipment.

Headquartered in Copenhagen Cleantech Park, Topsil spans production sites in Denmark and Poland and sales locations in Europe, Asia and the US. Topsil is publicly listed at the Nasdaq OMX Copenhagen stock exchange and was founded in 1959.

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