# A correlation for the maximum wetted radius on a spinning disc

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The application of a process liquid on a spinning disk as a thin film driven by centrifugal forces is a well-established concept for the wet processing, e.g., of silicon wafers. For a high quality spin process result, complete wetting of the wafer surface is essential. Hydrophobic surfaces prevent full wetting of the wafer surface in a regime of running and liquid conditions. Furthermore, the permanent drive to reduce the consumption of chemicals and to increase the disk size makes it difficult to achieve full wetting.

The present work derives a model for predicting the maximum wetted radius $R_{wet}$ on a spinning disc. The model is based on experimental observations of the spreading liquid under varying operating conditions, as exemplarily shown in Fig. 1a. Dimensional analysis reveals the non-dimensional combinations of the operating conditions and liquid properties $\Pi_1 = \mu / \sqrt{\rho \sigma R_{wet}}$, $\Pi_2 = \rho Q / \mu R_{wet}$ and $\Pi_3 = \rho \omega R_{wet}^2 / \mu$. They represent an Ohnesorge number and two Reynolds numbers based on the volumetric flow rate $Q$ and the rotational speed $\omega$, respectively. The acquired experimental database covers varying surface wettabilities in terms of static contact angles ranging from $\theta$ = 65°-105°, and material properties by using different working fluids. The process is characterized by a product of powers of the Π-groups. Fig. 1b exemplarily shows the correlated experimental data obtained for the static contact angle $\theta$ = 87°. The derived correlation is further used to validate analytical models for the maximum wetted radius presented in the literature [1,2].

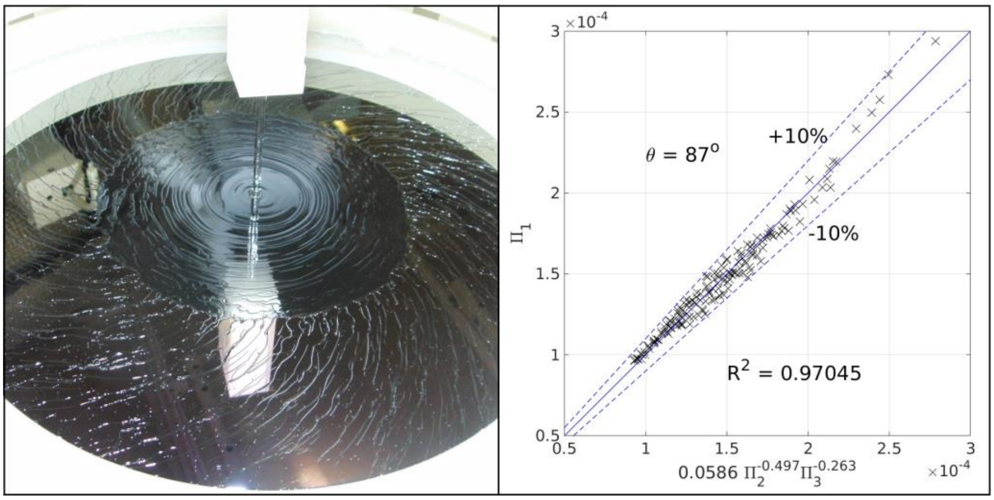


**Figure 1: (a) Top view on spinning disc with partial wetting; (b) non-dimensional correlation for experimental data at $\theta$ = 87°**

The presently proposed correlation is proven to describe the covered range of experimental data very well. The exponential model coefficients obtained from a least-squares fit to the data exhibit some dependence of the contact angle. This indicates that the complex effect of surface wettability cannot be universally captured using a single contact angle dependent non-dimensional pre-factor in the correlation.

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## References

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