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Wetting Behavior of Glass-Ceramic on Stainless Steel

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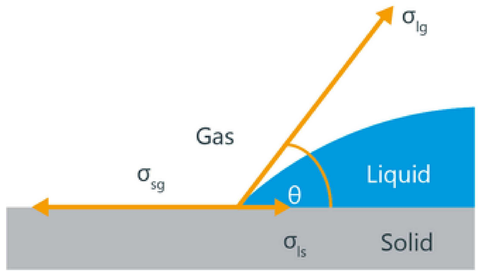
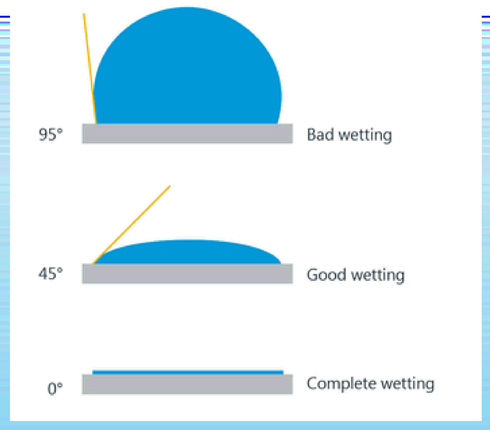
Background

- The contact angle is a measure of the wettability of a solid by a liquid



- Good wetting of metal by glass-ceramic is a prerequisite for achieving strong glass-ceramic to metal bond

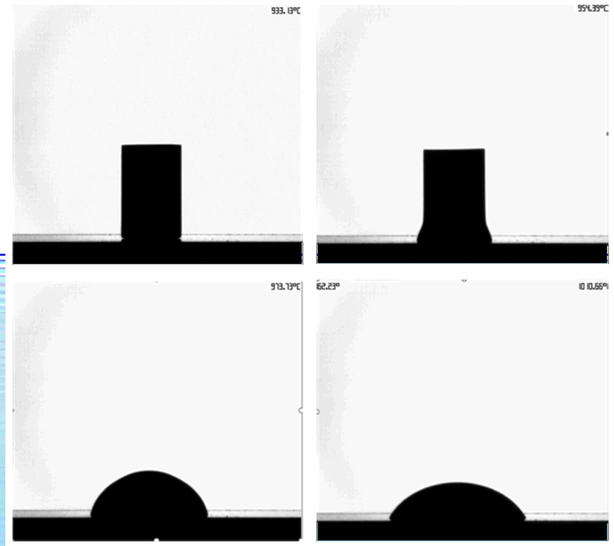


Objective

- Study the effect of metal surface condition, atmosphere, and temperature on contact angle between BPS glass-ceramic (lithium-alumino-silicate glass-ceramic) and 304 stainless steel

Approach

- Use a high temperature contact angle set-up: a glass-ceramic cylinder is placed on a metal plate and heated to 1000°C. Backlit image of glass-ceramic cylinder is continuously captured and is used to calculate contact angle as a function of temperature



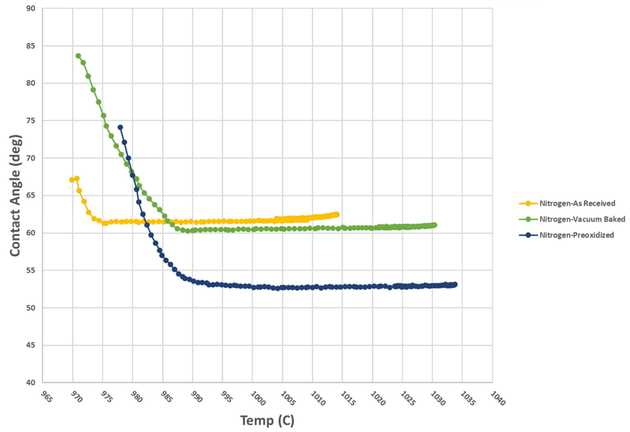
Progressive changes in shape of glass-ceramic cylinder as a function of temperature

References

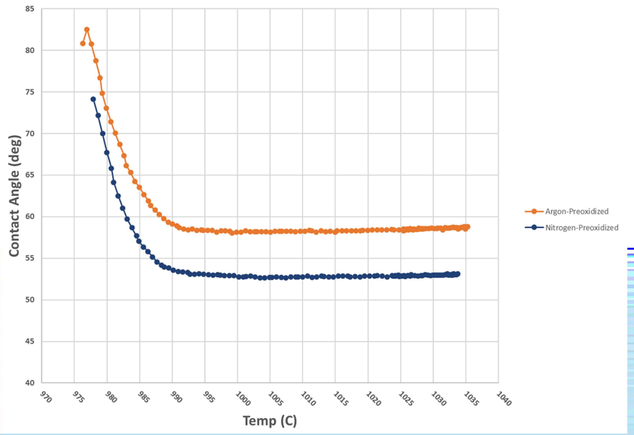
[1] https://www.kruss-scientific.com/services/education-theory/glossary/contact-angle/

Results

Effect of Steel Surface Condition



Effect of Atmosphere



Summary

- Glass-ceramic exhibits better wetting on pre-oxidized metal surface than as-received or vacuum-baked surface
- Glass-ceramic shows better wetting on metal in nitrogen atmosphere than in argon

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