Influence of morphology on thermal properties and CMAS resistance of gadolinium zirconate EB-PVD coatings

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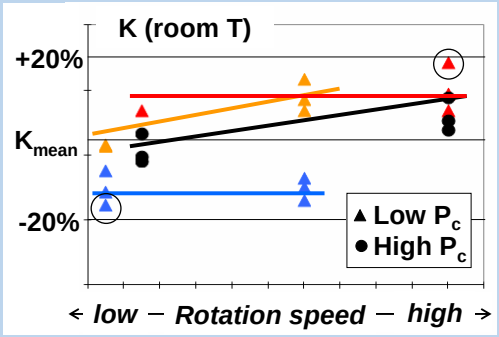
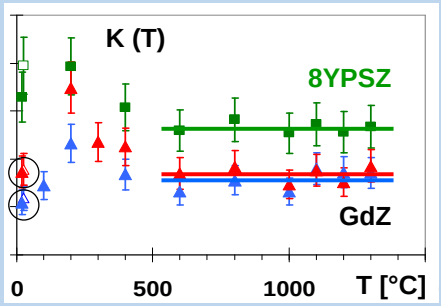
Context: Search for low-K and CMAS-resistant ceramic coatings for advanced high pressure gas turbines (with higher efficiency and longer lifetime)

Coating conditions: industrial coater; alumina substrates; coating parameters: rotation speed, pressure P_c, (temperature T_c)

Thermal Conductivity K

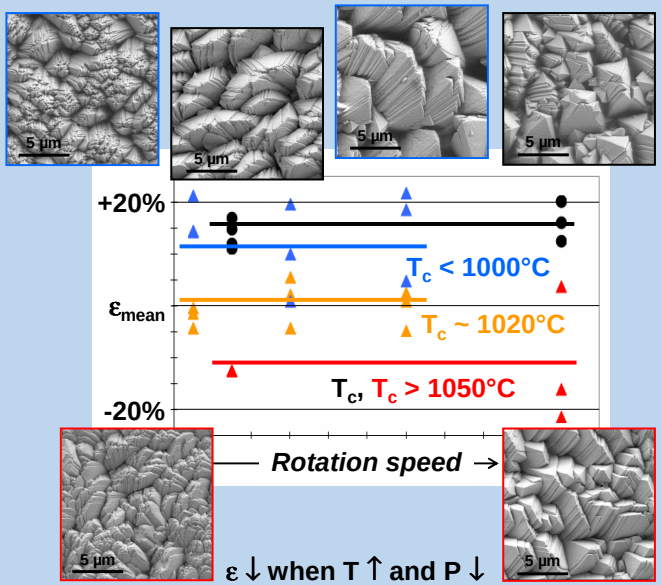
→ Laser flash (λ = 10.6 µm); vacuum





Total Porosity ε (~ open porosity)

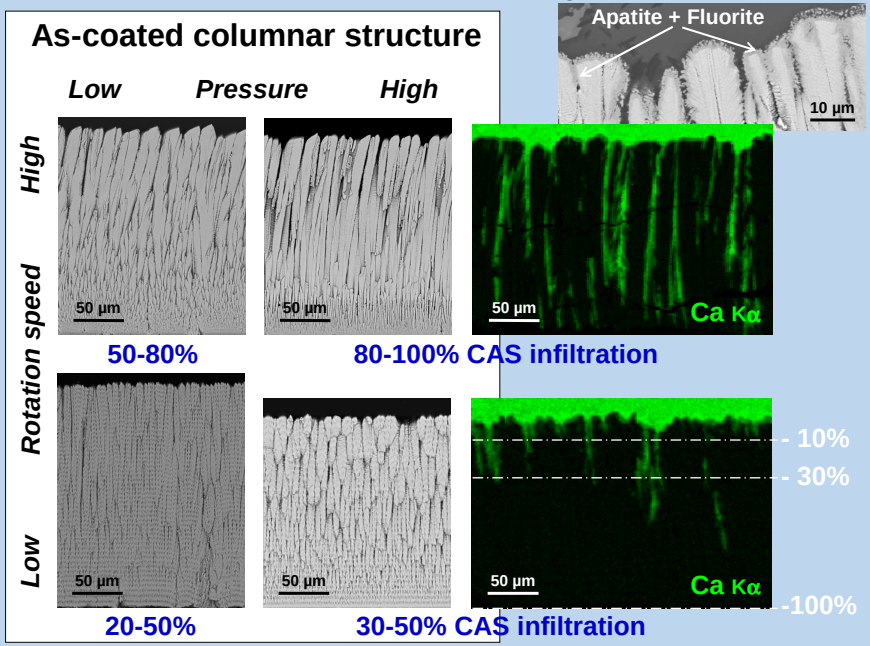
→ Archimedes' method in water

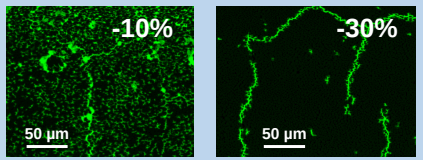


ε ↓ when T ↑ and P ↓
~ rotation speed independent
(≠ column morphology)

CMAS infiltration (1200°C/1h)

→ CAS contamination rate: 30 mg/cm²





Quantified CAS infiltration from surface parallel cross sections

Conclusion:

- thermal conductivity (specially at high temperature): ~ independent from coating microstructure
- development of CMAS-resistant coatings: CMAS-resistant composition (ex. GdZ) + suitable column morphology (narrow intercolumnar gaps); low rotation speed → limited CMAS infiltration