Study of the behaviour of YSZ dispersions in water

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STUDY OF THE BEHAVIOUR OF YSZ DISPERSIONS IN WATER
M. Della Negra, C. Knöfel, K. Tydén, M. Wandel

Motivations:
Better understanding of the behaviour of yttria fully stabilized zirconia in water for applications in wet ceramic processing

Questions:
Are Y\(^{3+}\) and Zr\(^{4+}\) leaching in solution from the cubic structure?
Is the particle surface affected?
Are the particle structure and composition affected?

Long term treatments in water at different pH
YSZ powder (0.15 µm), 40% in mass, pH adjusted with HCl or NaOH, 3 days milling. Liquid phase analyzed with ICP

Isoelectric point
YSZ milled in water for 3 days.

Powder potential and suspension pH
YSZ milled in water for 3 days

Conclusions:
Y\(^{3+}\) is leaching from the cubic structure in aqueous acidic solutions.
Zr\(^{4+}\) is leaching at pH=1, in smaller extent than Y\(^{3+}\).
The amount of Zr\(^{4+}\) in solution is low in the entire pH range explored.

Zeta potential and pH of the dispersion change with time, showing that the particle surface and the solutions are modified.
The equilibrium is reached in 1-2 days, depending on the pH.
Possible issues in suspension stability during processing.

The YSZ particle structure and overall composition are not affected.

We gratefully acknowledge:
Support by EUDP under the project ENS-64010502 "Fuel cells put to work" funded the Danish National C. Pardanaud
Contribution with ICP analysis by P. Roos
Help in the Raman analysis by C. Pardanaud
Support by EUDP under the project ENS-64010502 "Fuel cells put to work" funded the Danish National C. Pardanaud

Properties of the YSZ powder

Atom% from EDS analysis

<table>
<thead>
<tr>
<th>Atom%</th>
<th>Y</th>
<th>Zr</th>
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</thead>
<tbody>
<tr>
<td>13.9%</td>
<td>8.2%</td>
<td>13.7%</td>
</tr>
<tr>
<td>10.3%</td>
<td>8.2%</td>
<td>10.6%</td>
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</tbody>
</table>

Specific surface area: 12.9 m\(^2/\)g
Particle size (d\(_{50}\)): 0.15 µm

Initial solution pH = 5.9
Initial solution pH = 1.1

Contribution with TEM analysis by R. Boltenstein

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