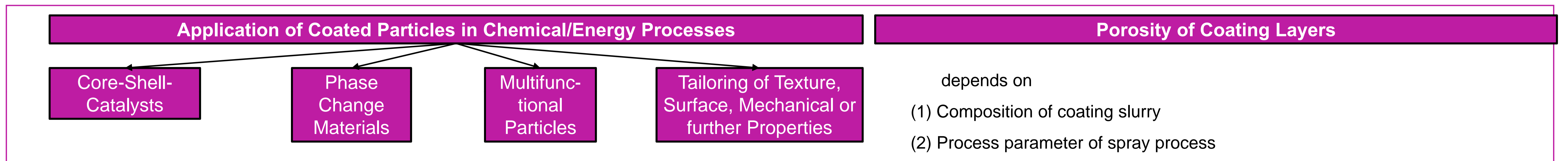


# Generation of porous coatings in a spray fluidized bed

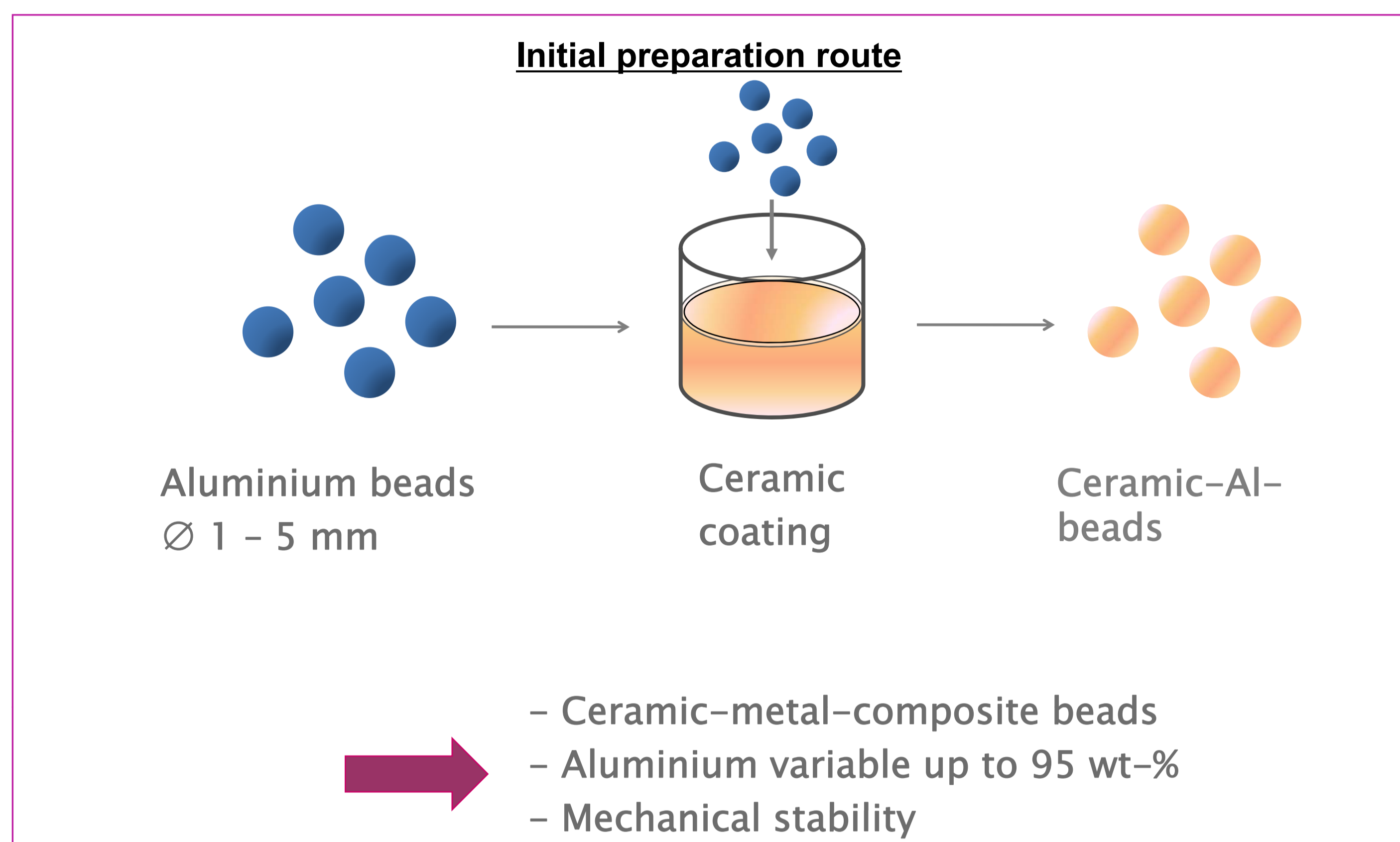
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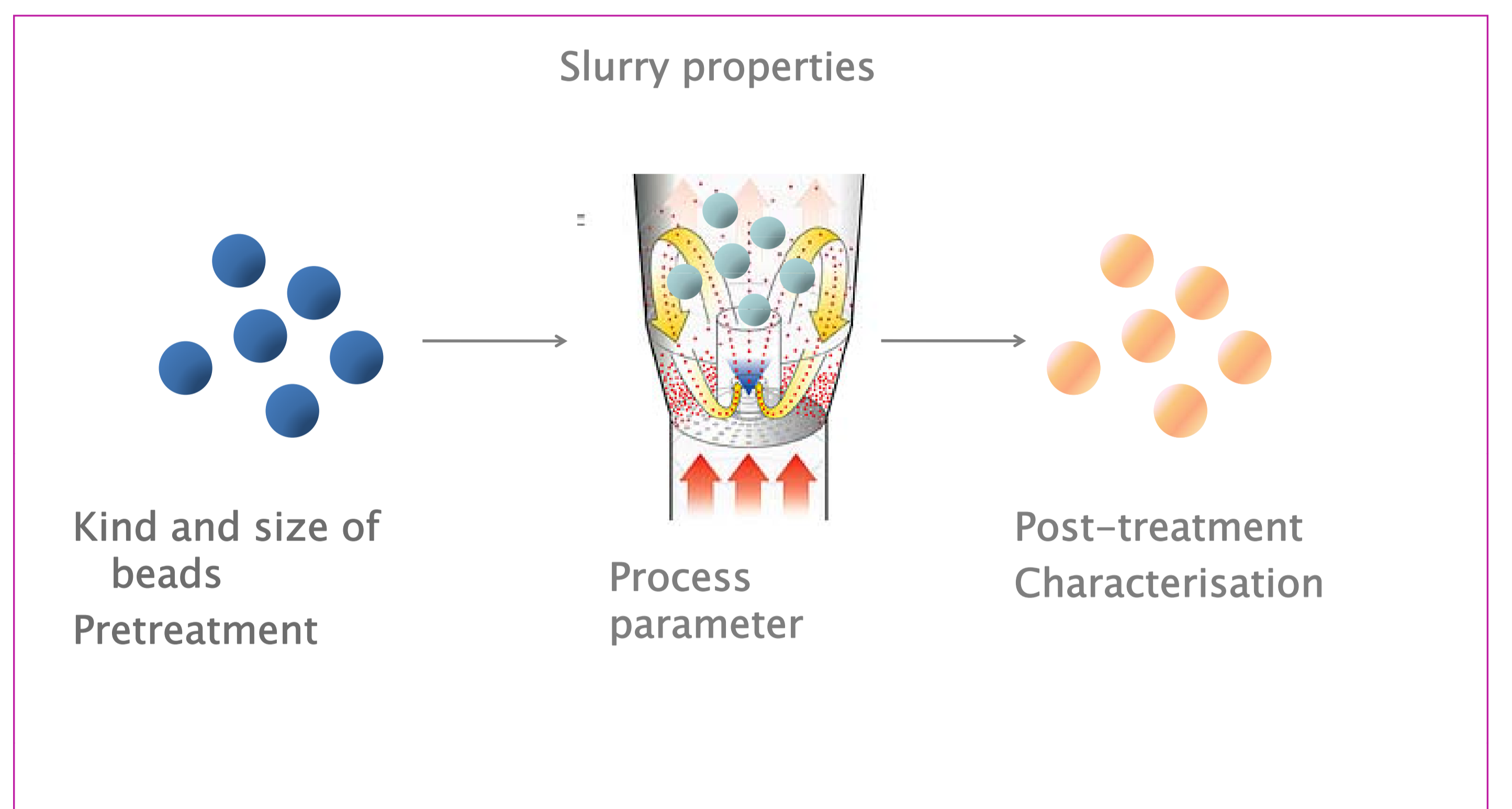


Problem Definition	Objectives	Cooperation
<ul style="list-style-type: none"> <li>Degree of porosity influences mechanical as well as heat and fluid transportation properties</li> <li>Porosity values between 5 and 95 % desirable</li> <li>Investigation of different spray systems</li> </ul>	<ol style="list-style-type: none"> <li>Development of parameter sets for different coating systems (e.g. polymer derived ceramics, zeolites)</li> <li>Evaluation of weighting of single parameter</li> <li>First model description</li> </ol>	<p><b>E. Tsotsas – U Magdeburg</b> Fluidized bed technology</p> <p><b>M. Scheffler – U Magdeburg</b> Ceramic technology, Characterisation</p> <p><b>J. Tomas – U Magdeburg</b> Particles technology</p>

## Preliminary Work



## Process transformation



## Characterisation

**Polymer derived ceramics – Mechanisms/ Processing**

Preceramic Polymer

- Polysilane
- Polycarbosilane
- Polysilazane
- Polysiloxane

Polymer/Filler

600 -1600° C

Porosity Cracks

Shrinkage

Ceramic Micro-composite

Fillers: e.g. Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>, TiO<sub>2</sub>; SiC, Si<sub>3</sub>N<sub>4</sub>,....  
Si, Ti, Mo, W, Nb; MoSi<sub>2</sub>, CrSi<sub>2</sub>,....

P.Greil, J. Am. Ceram. Soc. 78 [4] 835-48 (1995).

**Properties of coated beads**

- Number of coatings
- Drying conditions
- Pyrolysis conditions
- Type and amount of filler

- Layer thickness 10 - 50 µm
- BET surface area 270 -390 m<sup>2</sup>/g
- Density 2,4 - 3, 2g/cm<sup>3</sup>
- Porosity 10 - 30 %
- Flexural strength 100 Mpa
- Thermal exp. coeff. 4 - 8 \*10<sup>-6</sup>K<sup>-1</sup>

**Scanning electron microscopy**

Thermal treatment, air 600° C

Thermal treatment, inert atmosphere 600° C

**µ – Computer Tomography**

Thermal treatment, inert atmosphere 600° C

no cracks

Thermal treatment, inert atmosphere 600° C

cracks on surface (red arrows)

**Further Characterisation**

Layer properties: X-ray diffraction, Hg-Intrusion, Nitrogen adsorption, thermal analysis, thermal conductivity...

Coated beads: mechanical stability, abrasion, application tests