



THERMAL SPRAY PROCESSES FOR CMC COATINGS

IEK-1: MATERIALS SYNTHESIS AND PROCESSING

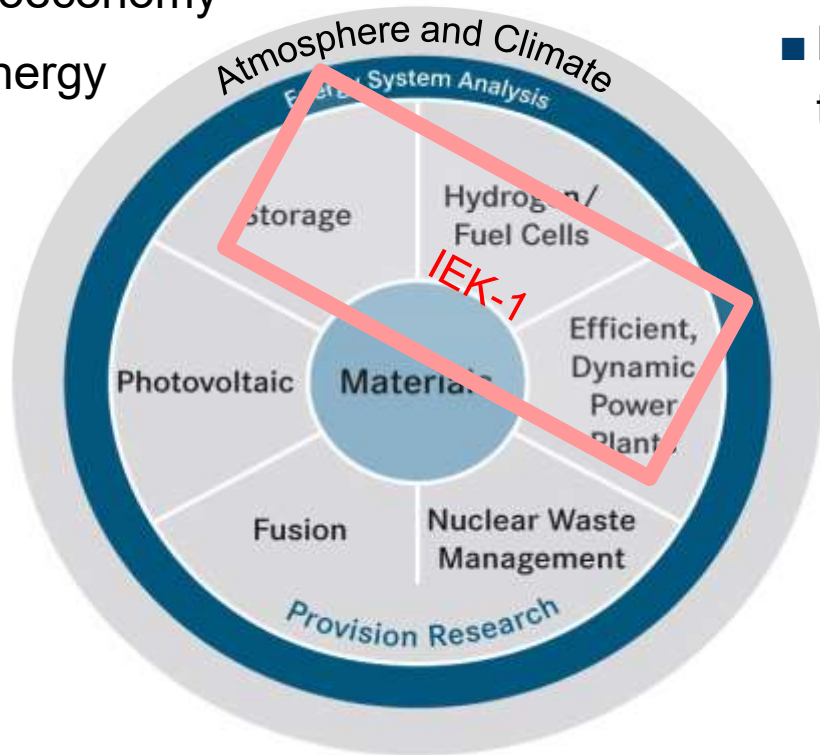
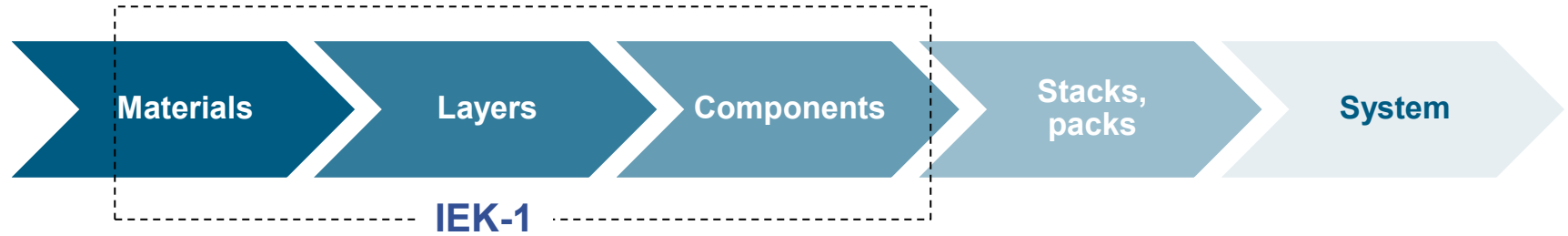
2023-11-20 COMPOSITED UNITED – JOUR FIXE „OBERFLÄCHENBESCHICHTUNGEN“

FORSCHUNGSZENTRUM JÜLICH

Institute of Energy and Climate Research – IEK-1

Multidisciplinary research
on campus Jülich

- Information
- Bioeconomy
- Energy



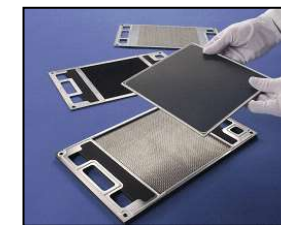
- Research for fundamentals, technologies, and systems of a climate-friendly energy system, and a resource efficient economy
- IEK-1 works from basic materials science to component manufacturing in industrial applications of ceramics for energy technologies



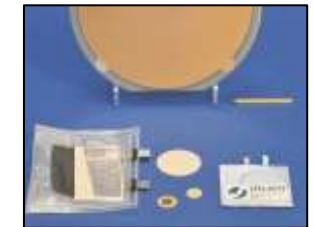
Materials for
HT-Technologies



Gas Separation
Membranes



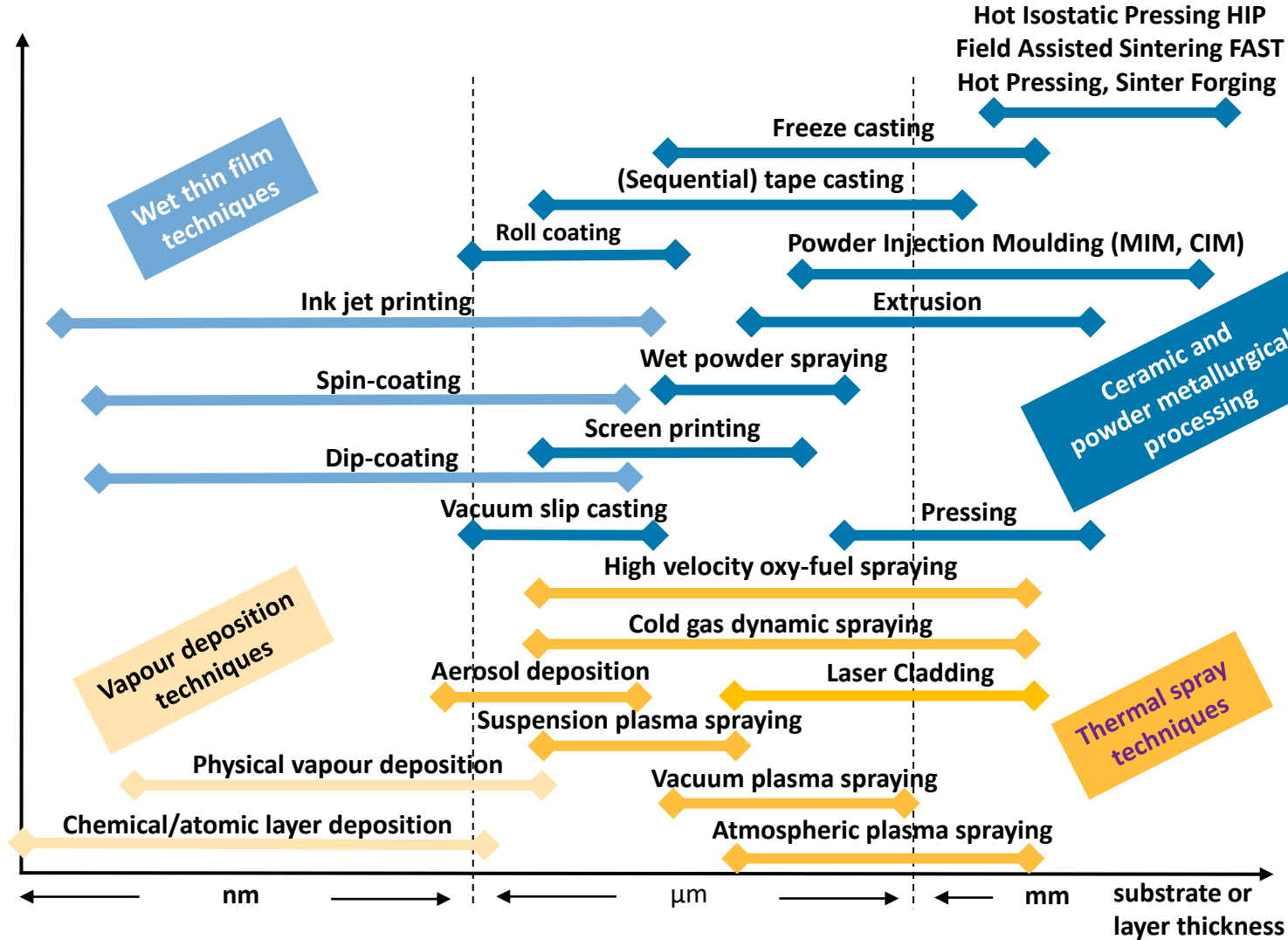
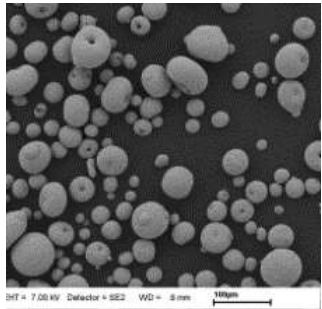
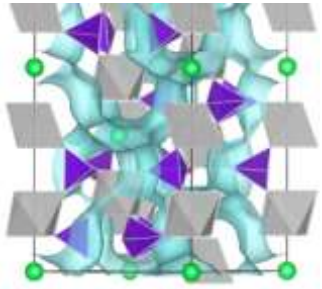
Solid Oxide
Cells



All-Solid-State
Batteries

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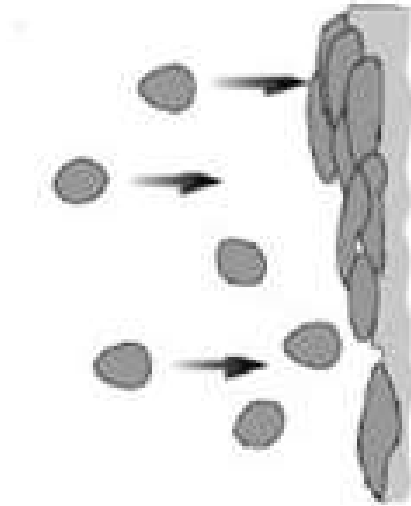
Developing reliable ceramic-based layered systems and composites



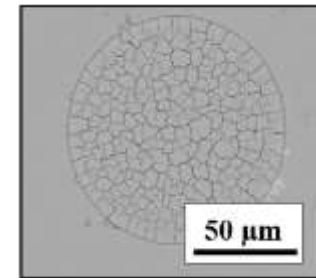
ENVIRONMENTAL BARRIER COATINGS

Example Yb disilicate coatings for SiC/SiC CMCs (Vaßen et al., Coatings 2019)

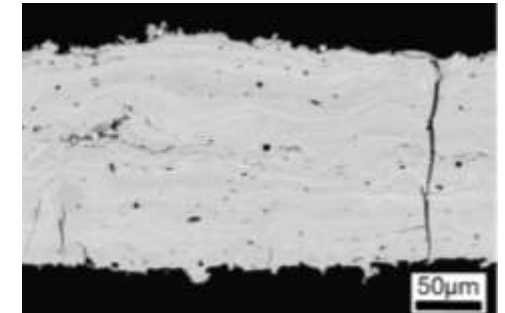
Atmospheric Plasma Spraying



Splat formation
(source Oerlikon Metco)



Splat morphology



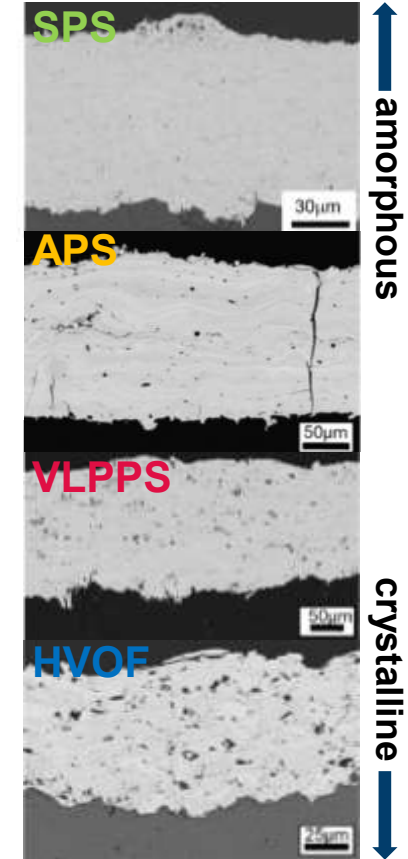
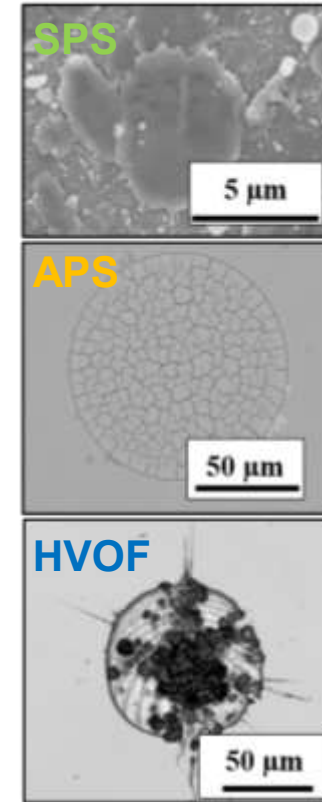
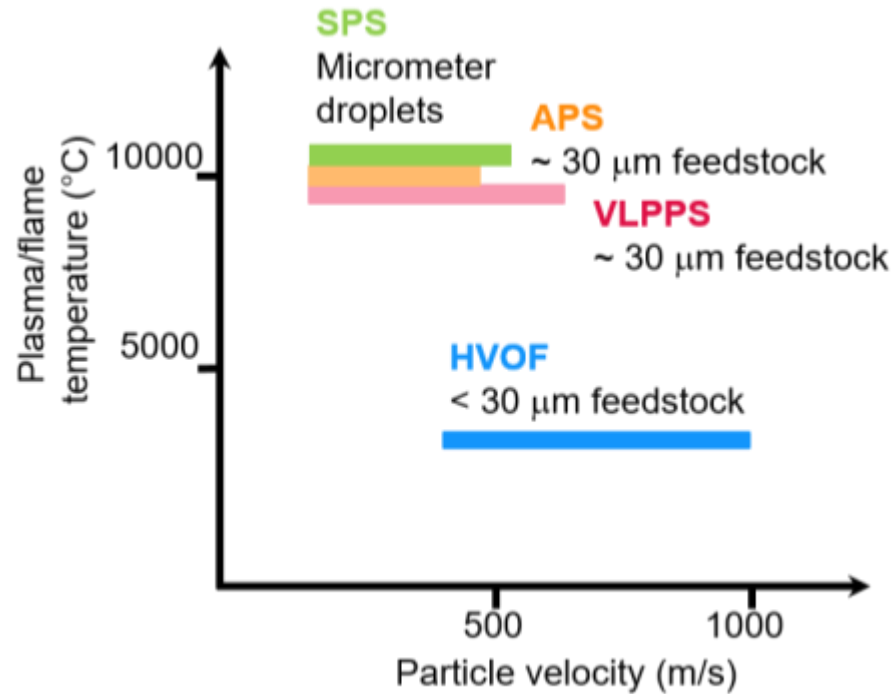
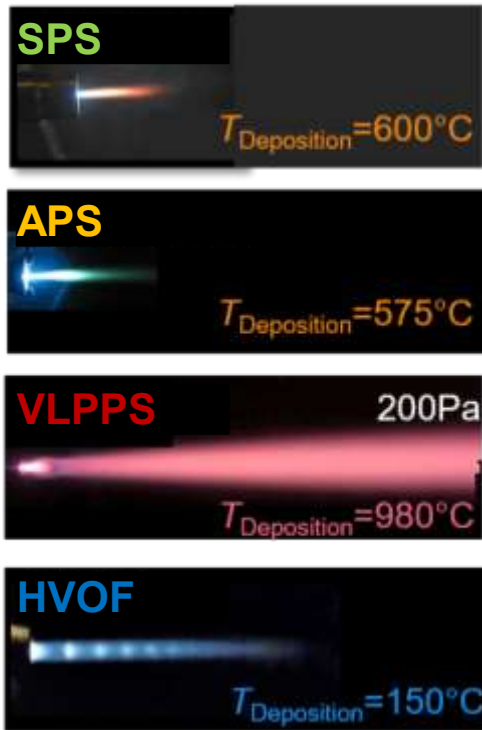
Cross section

- Morphology (compaction) in thermal spraying controlled by temperature (viscosity) and kinetic energy of impinging particles

- High temperatures and rapid quenching may lead to decomposition or amorphous coatings

ENVIRONMENTAL BARRIER COATINGS

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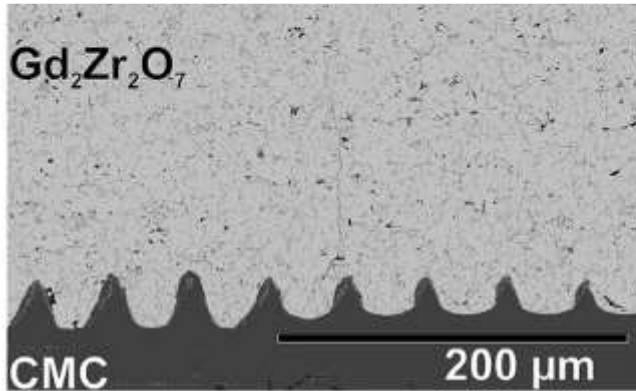


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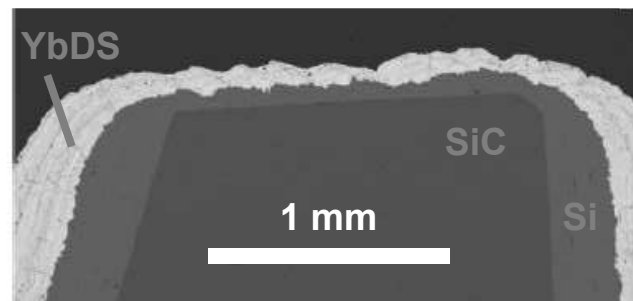
SOME DIRECTIONS IN EBC DEVELOPMENT

- Improved adhesion by laser structuring of interfaces

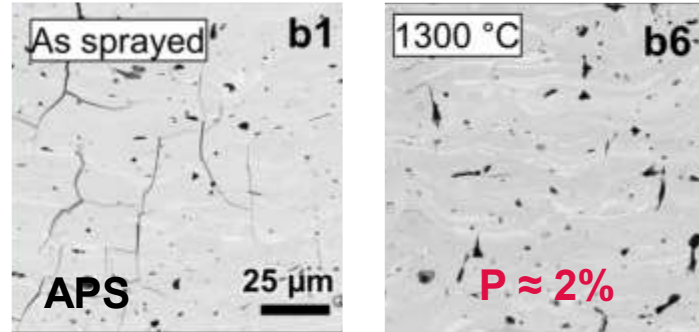


Gatzen et al., AEM 2020

- EBC deposition on complex shaped substrates/components



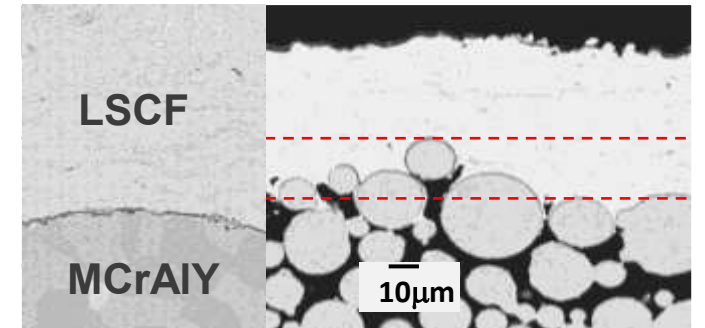
Wolf, PhD 2021



Bakan et al., JECS 2023

- Crystallization and crack healing in post heat treatment of EBCs

- Gas tight coatings on porous substrates (transfer to EBCs)



Marcano et al., IOP 2016

- Multilayer T/EBCs for improved temperature capabilities
- ...

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