LUCIDEON
insight creating advantage

CERAMIC ADDITIVE MANUFACTURING CONSULTANCY

Lucideon (formerly the British Ceramic Research Association) has seen and conquered ceramics challenges when every new technology has come into play, from casting to extrusion to injection molding – and ceramic Additive Manufacturing (AM) will be no different.

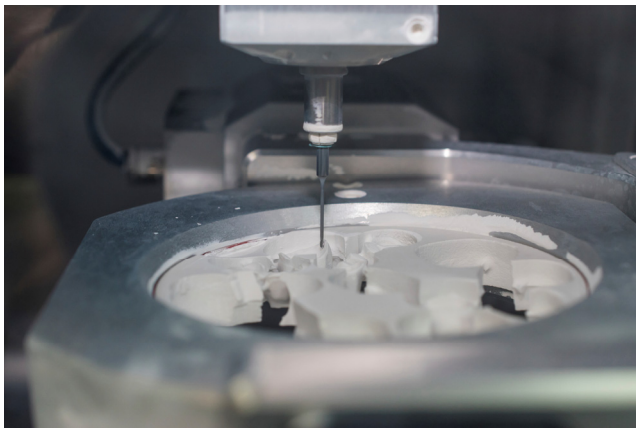
We help you to understand and optimize not only materials and product performance but also the process to produce high quality components that are right first time. And should failures occur, during the development, processing or in-use stage, we can investigate the root cause of those failures and work with you to prevent them happening again.

YOUR REQUIREMENTS

- High density
- High quality surface finish
- Lack of defects or flaws
- High mechanical strength
- High packing properties
- Shrinkage and deformation control

RAW MATERIALS FOR ADDITIVE MANUFACTURING

Don't assume off-the-shelf powder compositions will be optimized for Additive Manufacturing – you may need to modify the composition to include new additives and dopants. Particle size, distribution, shape and surface charge are also important and we can help you to understand these and tailor powder compositions to achieve the properties you need.



FEEDSTOCK AND GREEN STATE COMPONENT

Achieve the balance between good flow, high powder loading, and shape retention

- Rheology of the feedstock, e.g. thixotropic properties
- Choice of binder system, e.g. temperature/pH/shear/pressure sensitive binders
- Mixing process (avoiding agglomerates), raw materials, surface tension and zeta potential

Suboptimal feedstock will result in issues for both green and sintered components

- Flocculated systems/low density
- Loss of precision during shaping
- Poor surface finish causing defects

- Voids/flaws leading to stress concentrations
- Inhomogeneous green components
- Poor mechanical properties

SINTERING PROCESS

Achieving a high quality green component is only half the challenge. Controlling the sintering process presents its own challenges, including:

- Removing residual moisture to prevent collapse of structure or formation of defects/voids
- Deformation and shrinkage. Understanding and modeling this can assist design optimization of the green component. This will largely depend on the body composition and shape
- De-bind and firing process. Optimizing the speed and temperature is critical to avoid pressure build-up and structure collapse
- Thermal gradients. These lead to crack initiation and propagation, particularly in unsupported structures and complex geometries.

SCALE-UP AND OPERATING WINDOW

Changing the feedstock and parameters for each new design is unviable for large scale manufacture or rapid prototyping for any process. In Additive Manufacturing, where the whole appeal is the ability to rapidly produce new designs, this is particularly undesirable.

- Characterize and optimize the feedstock, define the operating window for the important process and raw material parameters, understand their interactions/effects when they deviate, and then modify the process to make it more flexible
- Reusing powders or feedstock will slowly change the microstructure and chemistry. It is important to understand the limitations of how many times can they be reused without compromising performance.

Lucideon has over 70 years of experience in ceramic processing and optimization throughout all stages of a technology's maturity. Don't assume this new technology will not have the same age-old challenges and some new ones too. Talk to us about how we can utilize our expertise and capabilities to support your additive manufactured materials, components, designs and processes.