ADDITIVE MANUFACTURING (AM)
OF CERAMICS

At Lucideon, we’ve seen and conquered ceramics challenges each time a new technology has come into play (from casting to extrusion to injection moulding), so we’re pleased to offer consultancy around AM. From ensuring your feedstock is correct to helping you to optimize the sintering process, our experts are on hand. There are lots of forming techniques out there so we’ve written a white paper that guides you through what’s available and the pros and cons of each.

Download it at: www.lucideon.com/am-wp

We’re also part of a new £900,000+ research project, led by KW Special Projects (KWSP) and funded by Innovate UK, that is set to rethink the additive manufacture of ceramics. Called CerAMake, the project aims to exploit existing deposition technologies to provide improved properties via a scalable ceramic binder jetting platform. The outcome should bring significant competitive advantage to the UK’s commercial pottery sector, ceramic filter market and wider industry for additive manufactured ceramics.

Find out more at: www.lucideon.com/ceramake

I’m delighted to have joined the Advanced Materials and Processes (AMP) team as Business Manager and I’m looking forward to meeting as many of you as possible in the future. In the short time that I have been with Lucideon, I have come to fully appreciate the breathtakingly wide spectrum of services that we offer.

This newsletter provides an insight into some of our exciting activities and novel technologies, including Ceramic Additive Manufacturing, Ceramic Matrix Composites (CMCs) and Inorganic Controlled Release Technology (iCRT), all of which are supported by an impressive team of scientists, consultants, technicians and managers.

Our experienced team also supports organizations from many different sectors who have day-to-day practical production, processing or materials related challenges, through either our consultancy or Technology Partnership solutions. It’s the sheer breadth of activities, from ground breaking R&D to everyday production challenges, that makes my role here at Lucideon fascinating.

We are able to deliver these solutions by utilizing the skills of the wider Lucideon teams both in the UK and USA and by taking advantage of our comprehensive range of analytical, testing and characterization capabilities, and our pilot scale processing facilities.

I’m not the only new starter in the AMP team. As you’ll see on page 4, we’ve employed three PhD graduates, all with different areas of specialism but who all focus on the optimization of ceramics materials and processing in industry. Wirat Lerdprom has also joined us. With a PhD in Ceramics and Glasses, Wirat will be working on the Flash Sintering of whitewares. We’ve also employed a number of laboratory technicians and, across the Group, we will have recruited over fifty new people this year.

I hope that you enjoy reading about the work that we’re doing.

Please let me know what your challenges are; the team here is sure to be able to help.
CASE STUDY
IDENTIFYING THE ROOT CAUSE OF CRACKING IN ADDITIVE MANUFACTURED COMPONENTS

THE CHALLENGE
When one of our clients was experiencing periodic cracking in components that were being printed at their facility, they were unable to correlate the root cause to any of their processing parameters.

WHAT WE DELIVERED
We analyzed both the residual stress inside the component and the changes in the recycled powder, both of which were considered likely contributors to the failure. We were able to identify the root cause as an issue in the quality of the recycled powder, and were able to recommend changes to powder handling processes, recycling programs and the in-line process settings, in order to prevent these issues moving forward.

VALUE TO THE CLIENT
Our client was able to confidently produce high quality additive components without the scrap costs associated with periodic failures, or the concern of reliability issues in their end use application, reducing the overall costs for the company.

EVENTS
We’ve been out and about a lot this year, talking about how we can help to solve processing challenges and how our technologies are driving change.

We helped to organize a conference on Flash Sintering in Portugal in March and at the beginning of May we were at Ceramics Expo in Ohio, while July saw us at the inaugural Ceramics UK conference.

We’ve also held events at our UK headquarters in Stoke-on-Trent, hosting an ACerS UK Chapter workshop on Additive Manufacturing, a visit from our fellow members of the CDP (Center for Dielectrics and Piezoelectrics) and a Ceramic Innovation Network event – ‘Accelerating Clean Growth in Ceramics’.

UPDATE
FLASH SINTERING FOR BATTERIES FEASIBILITY STUDY

Lucideon and Ionotec, a leader in solid electrolyte manufacture for sodium batteries, recently announced the completion of an Innovate UK collaborative feasibility study to assess the potential for Lucideon’s Flash Sintering technology to manufacture beta-alumina solid electrolytes, a critical component of sodium batteries.

Carried out over a twelve-month period, the project found that Flash Sintering can significantly lower the furnace temperature (and time) required to process beta alumina shapes by 300°C, thereby increasing productivity by up to three times with lower furnace costs and longer furnace life. New battery concepts involving thinner-walled electrolyte discs and tubes may also become possible with this technique.

We were extremely pleased with the results and are considering approaches to develop this unique technology further for exploitation in the UK.

Find out more on our website - www.lucideon.com/batteries
VPP
AMP is all about optimizing and developing new processes, and helping our clients to solve any processing issues they may have. One area we’ve been working on recently is Viscous Plastic Processing (VPP) of ceramics.

VPP is a technique developed to produce ceramics or composites with improved properties by eliminating microstructure defects by breaking down agglomerates. It is superior to alternative methods as it completely de-agglomerates the powder during mixing and maintains that state during the green forming and shaping stages.

**BENEFITS INCLUDE:**
- Enhanced material consistency
- Easier green state handling
- Increased strength
- Increased fracture toughness
- Superior surface finish
- Improved processing
- Decrease in the number of losses/faults
- Ability to form complex shapes

From multi-layer composites to fuel cell glass seals, dental implants and ceramic Additive Manufacturing feedstock, VPP has a variety of applications. Contact us to learn more.

MICROBEADS PROJECT
In June 2018 the UK issued a ban on plastic microbeads rinse-off products, such as facial scrubs, and a proposal for restriction of leave-on microplastics (such as fillers for creams) is expected to come into force in 2021.

Finding environmentally-friendly alternatives to these microplastics is critical for many industries, including the personal care industry. We’ve just completed a nine-month feasibility study to assess whether polymers in microbeads can be replaced by environmentally-friendly inorganic alternatives.

With our expertise in glass and ceramics, we turned to these materials to find alternatives. As they’re naturally present on Earth, they’re not harmful to the environment, and are not common allergens (i.e. not harmful to people). The study was funded in part through the Plastics Research and Innovation Fund (PRIF), supported by Innovate UK.

Replacing microbeads poses a particular challenge in terms of engineering as the size and the shape of the bead (its sphericity) must be accurate so that the feel of the cosmetic product is not compromised. The alternative material must also have the same or a lower manufacturing cost to meet any commercial challenges, and must be able to be produced using a green process.

As a result of this study, we were able to produce two microplastic replacement materials, one based on glass and one on engineered ceramics. We also evaluated these in simple model formulations. Samples are available for testing.

As the microplastics ban will affect other industries and products, it’s hoped that Lucideon’s proprietary technology platform could also be used for fertilizers, seeds and laundry detergents, among other things.

R&D PROJECTS
We believe that research and development and turning ideas and innovation into commercial products and processes is central to staying ahead of the competition.

We work with a number of collaborators on publicly-funded projects and also carry out our own R&D work in house, developing proprietary technology platforms that can be incorporated into our clients’ products and processes.

Some of our projects include:

**CMCs**
We’re evaluating CMCs utilizing a ceramic based matrix which will follow processing routes similar to those developed for carbon fibre reinforced epoxy composites to solve issues during processing.

**iCRT for agriculture**
We’re designing an alternative for traditional fertilizers based on our iCRT (inorganic control release technology). The project focuses on encapsulation of Nitrogen in fusion glass as a platform for controlled release of Nitrogen.

**iCRT-deter**
Our platform deters the abuse of opioids and other drugs by making the drug difficult to access by crushing, heating, dissolving, etc.

**HyMedPoly**
Following on from our work in this EU Horizon 2020 project, we’re investigating antibacterial and resorbable materials for medical applications, such as wound care and implants.

What are your R&D Projects?
We’d love to hear what you’re working on and whether we could be of any help. R&D projects can often be side-lined due to time constraints – that’s where we come in! We can act as an extension to your team, helping you to bring the products, processes and technologies of the future to market quickly.

Contact Kambiz Kalantari, Innovation Manager to discuss your needs.
Tel. +44 (0)1782 764343, kambiz.kalantari@lucideon.com.
NEW STARTERS

It’s the expertise, knowledge and skills of our people, and the relationships that they build with our customers, that make Lucideon what it is. We’re constantly investing in new people (by the end of the year we will have recruited over 50 new employees).

Three PhD graduates have recently joined the AMP team – Dr Samira Bostanchi, Dr Agata Lapa and Elliot Douse.

Samira completed her PhD at the University of Sheffield and joins Lucideon’s Flash Sintering team as a ceramics technical consultant, focussing on ceramics processing for artificial hip replacement applications. She has a background in Physics (BSc) and Nanoscience (MSc) which she further explored during her PhD.

Dr Lapa joins the Advanced Materials and Processes team working on healthcare, agriculture and geopolymers projects, exploring new applications for glass and ceramics. After finishing a degree in Biomedical Engineering in Krakow, Poland, she was a PhD student in the European Funded Project HyMedPoly - a European collaboration between universities and industrial institutions such as Lucideon.

Finally, Elliot joins the organization as a technical consultant following his research in ceramics for aerospace applications. A Chemistry graduate from the University of Surrey he furthered his studies at the University of Birmingham with a research fellowship exploring ceramic materials in manufacturing.

SAGGAR-LIFE

We’ve recently received funding as part of the government’s Faraday Battery Challenge, which brings together world-leading companies and academia to accelerate R&D of electric car battery technologies.

The ‘Enhanced Lifespan Saggars for Battery Material Production Scale Up’ (SAGGARLIFE) project, co-funded by the UK’s innovation agency, Innovate UK, will investigate how to substantially increase saggar lifespan, thereby offering a sourcing route for scalable saggars for long-term commercial-scale production of battery materials.

Johnson Matthey will provide scientific expertise in battery material production and, with longstanding experience in refractories consultancy and testing, Lucideon will develop testing programmes to provide comprehensive physical and chemical data.

CERAMICS WHITEWARES & REFRACTORIES TRAINING

We’ve just published our training schedule for 2020.

Here are some of the courses that we’ll be offering.

- MATERIALS SELECTION
- SLIP CASTING
- KILN FIRING
- TILE MANUFACTURE
- PRESSURE CASTING
- REFRACTORY DESIGN

This is just a selection of the wide range of courses taking place in 2020. We can provide the training at our site or at yours. Alternatively, we offer training through a series of interactive webinars. And, if you don’t see a course that suits you, we can tailor one to fit your requirements.

Further details are available on our website.

www.lucideon.com/training

or contact me, Caroline Mullington, caroline.mullington@lucideon.com, tel. +44 01782 764422 to find out more.

www.lucideon.com
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Processing Problem?

With over 100 years’ experience of ceramics, we’re here to help. Think of us as an extension to your team, people who can help when you’re pushed for time or when, no matter what you try, you can’t seem to move forwards.

These are just a few of the issues that we can help with:

- Slip rheology
- Raw material and body problems
- Powder processing
- Forming
- Firing
- Glazing
- Drying

Call Mark Crooks now to find out how we can help.

+44 (0)1782 764346