



EPO SME CASE STUDIES | LITHOZ

3D printing opens up a new chapter for ceramics

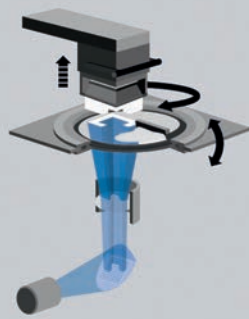
A spin-off from the Vienna University of Technology (TU Wien), Lithoz specialises in the 3D printing (additive manufacturing) of high-performance ceramics. Thanks to the university's far-sighted IP strategy, this Austrian company is able to offer complete systems comprising lithographic printers and materials. Staff are encouraged to develop – and are rewarded for coming up with – new and patentable ideas. For Lithoz, not every invention has to be ground-breaking to be worth patenting, and the company is now focussing on building up its own patent portfolio to strengthen its market position.

3D-printed sensor mountings, impellers and gears for industrial applications.



Lithoz is an additive manufacturing company that has developed patentable methods and formulas for fabricating high-performance ceramic products with industrial applications that could not have been realised using traditional technologies. It has created 3D printers, a variety of new ceramic materials and dedicated software for printing production. Before the development of the lithography-based ceramic manufacturing (LCM) process, the density and strength of 3D-printed ceramics were not sufficient to meet the standards of the ceramic industry. With its technology and materials, Lithoz now achieves a high level in the material properties of density and strength, and its quality and precision are such that the process can be used for serial production.

TECHNOLOGY PROFILE



In contrast to subtractive ceramic forming processes, in which the desired component is carved out of a solid, 3D printing is additive. The technology is based on the selective curing of a photosensitive resin which contains homogeneously dispersed ceramic particles. The illustration shows a projection system, slurry in a transparent vat, a building platform and a recoater. In Lithoz's LCM process, the printed product is not released from the building platform until it is pulled out of the vat. Bottom-up exposure keeps material consumption very low. The process can run with a capacity of only 10 ml, and the remaining material is left for further use. Due to the quick-locking cartridge system, a change of material can be completed within five minutes. The LED-based projection system requires no special safety precautions and keeps energy costs at a very low level. After sintering, the final density is well above 99% of the theoretical density, meaning that the mechanical properties are equal to conventionally fabricated parts.

An opening in the market

Lithoz was founded in 2011, and delivered its first production-ready machine a year later. It has already received a number of industrial awards, and in 2014 saw its revenue pass the EUR 1 million mark. Its main customers are universities, research institutions, companies producing ceramic parts, and biomedical companies. The market for additive-manufactured, high-performance ceramic parts is new, and growing rapidly. Other companies are attempting to penetrate the market, but the quality and variety of Lithoz's material remain unmatched.

Continuous expansion of the business into sectors including the manufacture of ceramic cores for turbine engine components and solutions for biomedical components such as blood pumps and bone implant materials has allowed the company to grow systematically and hire new staff, bringing the total number of employees to 36. In addition to its standard products, Lithoz also offers customer-specific developments, feasibility studies and customised solutions. In 2015, the company expanded into the US and Chinese markets, and joint research activities with a Chinese university started in the same year. Although material development and production is now also undertaken in the US, every new machine is produced in its entirety in Austria.

Partners in IP

Lithoz founders Johannes Homa and Johannes Benedikt started their academic careers at TU Wien, where the core IP for Lithoz was generated. In the four years prior to Lithoz being founded, Homa and Benedikt's intense collaborative research produced six jointly owned patent families, and eventually the proof of concept in 2010. The team recognised the unique potential for a new class of materials back in 2006, and decided to develop the technology. Once they started work on the development of the ceramic material with Professor Robert Liska from the Institute of Applied Synthetic Chemistry and Professor Juergen Stampfl from the Institute of Material Science and Technology at TU Wien, it soon became apparent that new concepts for machines and software were also needed.

“The combination of patents and trade secrets is very important for a small high-tech company such as Lithoz, as they allow us to stay ahead of our competitors for longer.”



Johannes Homa
Founder and CEO, Lithoz

TU Wien sought a commercial partner to fund the necessary further developments, and in 2007, after six months of conducting experiments on its own, it was joined by dental company Ivoclar Vivadent AG from Liechtenstein, who agreed to sign up to a joint development programme, providing financial support as well as input from their in-house research. Ivoclar was already well established in the fields of dental instruments and materials across the entire treatment and fabrication process for direct restoratives and prosthetics.

TAKEAWAY

UNIVERSITY/SPIN-OFF INTERACTION

A university's IP strategy can have a big impact on the success of its spin-offs and can bring additional benefits to industry sponsors, creating a win-win situation for all involved. In the past, a research co-operation contract would probably have granted the sponsor, in this case Ivoclar, exclusive rights to all applications of the developed technologies. Instead, since Ivoclar's business case is focused on dental applications, TU Wien secured the freedom to pursue new business opportunities for all other applications. The outcome of this agreement allowed new and innovative research projects to be fostered, which led to the successful spin-off, Lithoz. The research and licensing income generated by this helps the university to attract and retain valuable researchers on new applied projects. At the same time, Lithoz gains expertise and technological advantages from the university. Ivoclar, the sponsor, also benefits from its relationship with Lithoz as an industrial co-operation partner.

TU Wien's Research and Transfer Support office divided the exploitation rights into dental and non-dental applications. Ivoclar received the exclusive rights for dental applications. For all other application areas, TU Wien, as co-owner with Ivoclar of the patent families that resulted from the joint collaborative research, has the ability to grant licences. This strategy allowed TU Wien to spin off Lithoz, by providing it with the necessary licences in 2011.

Growing a patent base

The spin-off was based on a licensing agreement with the university which granted access to the patent rights. TU Wien was completely free to license in the non-dental field, which means that Lithoz has access to a large patent portfolio that includes the territories of the EPO, the US, Japan and China. Being a small company, Lithoz's patents are essential if it is to avoid being blocked by competitors when exploiting its technology, and if it is to ensure a premium price for its high-quality products. As 3D-printed ceramics for industrial applications are still an emerging market, Lithoz knows most of its competitors and monitors their activities at conferences and trade fairs to detect products that might violate their patents. Competitor watch is also done in an informal way through customers who identify and report potential infringements in the marketplace. Although it has not had to do so up to now, Lithoz is prepared to take legal action in core areas, if necessary. The question of who takes the lead in such cases will be decided by TU Wien and Lithoz on a case-by-case basis. Legal requirements regarding which legal entity has the right to sue in a particular territory will have to be taken into account.

“Patents on scientific research results are in many cases an essential precondition for starting a technology-based university spin-off company.”



Peter Karg
Transfer Support, TU Wien

In 2014, Lithoz reached an important milestone when Hans J. Langer, CEO and founder of EOS, one of the first commercially successful additive manufacturing enterprises, acquired a shareholding in the company. Lithoz's robust patent base and its know-how played a key role in this strategic decision, which brought benefits to both parties. Mr Langer, who has a strong portfolio in the 3D printing of plastics



CeraFab 7500: Additive Manufacturing System for Ceramics.

and metals through EOS, gained a partner that had mastered the additive manufacturing of ceramics, and Lithoz strengthened its credibility on the world market by partnering with a recognised player in the 3D printing industry, which in turn helps to attract new customers.

Research activities are still of essential importance to the company and generate one-third of its revenue. Lithoz continues to co-operate with TU Wien and other research partners, and is involved in several national, European and international research projects to develop new applications and technologies which will improve upon its products. Under the agreements on which these co-operation activities are based, the ownership of new inventions resides with the partner or partners who create them. Access rights are granted to the other partners on a fair and non-discriminatory basis.

Managing the magic

Lithoz has dedicated staff members who support the management in making IP decisions. One employee with a background in material science manages R&D projects. Another, who has experience with patent management, runs prior art searches, liaises with external patent agents and helps monitor competitors' developments. Patent drafting is outsourced to an external patent agent, who helps the company make strategic decisions in the examination phase.

TAKEAWAY

MANAGING IP

To prevent strategic issues such as patents being overlooked in the course of day-to-day business, it is good practice to have dedicated staff – for example a patent manager and an ideas manager – whose job it is to ensure that the necessary IP management actions are taken in good time and in the right order.

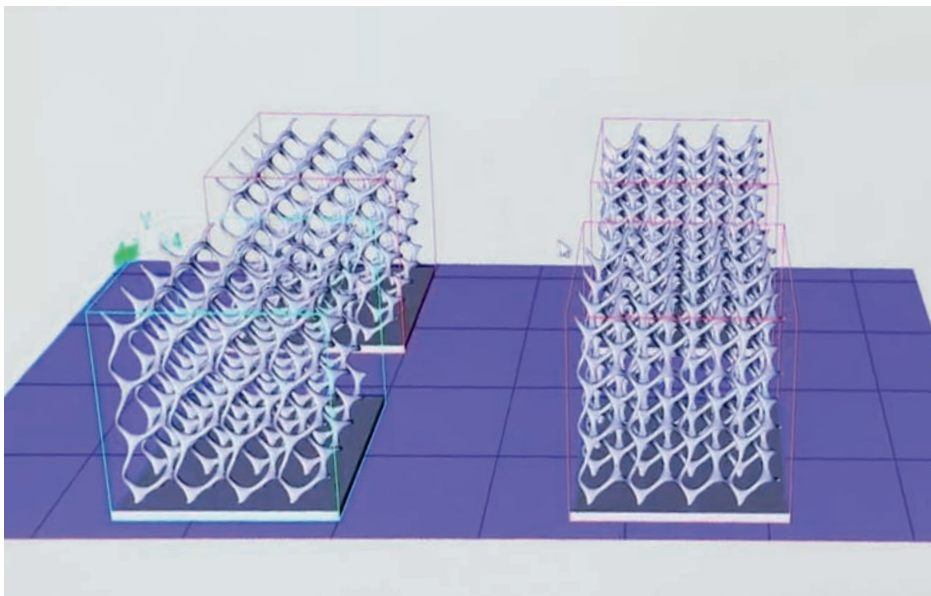
Lithoz also has an “ideas manager”, who serves as the first point of contact for staff with ideas for improvements, and ensures that they are discussed and reviewed by management. Lithoz staff are free to pursue their own ideas. “This creative freedom opens up new ways of approaching existing problems and led to our latest, very promising invention, for which we recently filed a patent application”, explains Homa. An inventor reward scheme, with awards at the filing, grant and use stages, provides additional incentives for creativity.

TAKEAWAY

CREATING IP

To foster the generation of new ideas, it is an advantage to have an open and inviting climate in which people from different backgrounds can come together to solve problems creatively. Lithoz believes it is essential to give employees enough freedom and incentive to pursue their own ideas in order to generate new inventions.

Even though Johannes Homa is responsible for all in-licensing activities, he can still count on the expertise of the university's Research and Transfer Support office for additional support. The office works in close co-operation with Ivoclar's patent department and is able to clarify questions regarding the interpretation and execution of various clauses in the licensing agreement, or the kinds of questions that typically arise about how to adapt it to the company's new fields of business.



Production based on Computer-Aided-Design (CAD) data.

Strategising market protection

Consistent with its business strategy, Lithoz conducts its own research and development activities. With staff in the fields of polymer chemistry, ceramics, mechanical engineering, process management and application and software development, the whole process chain is covered within the company, which helps it to develop its own IP.

Lithoz makes its first filings with national offices or the EPO, and follows these with international (PCT) applications. PCT applications give it time to assess whether the commercial value of the invention justifies further patenting costs, because the decision regarding geographical protection can be extended from 12 up to at least 30 months after the priority filing. Within this time period, the applicant receives an international search report with an opinion on patentability and has time to carry out market research.

As an alternative to the PCT route, the option of filing applications directly in the US, Japan and China is also assessed. Factors to be taken into consideration are the cost of filing, the quality of the search report, and coverage of the key markets. Important inventions aimed at safeguarding the technology pipeline are usually filed with the EPO directly, in order to get the high-quality European search report with an expert opinion within six months.

Lithoz also considers filing minor improvements. “Not every invention has to be ground-breaking to be worth patenting,” Homa says. “Also minor improvements can play an important role in the company’s overall IP strategy.” In these cases, the main aim is to keep competitors at a distance and to strengthen the portfolio for strategic future

business-to-business collaborations and possible cross-licensing options. In cross-licensing, it is usually an advantage to have a larger patent portfolio. Filing patents facilitates the creation of defensive publications, which raises the bar for competitors’ applications, which might otherwise limit Lithoz in its business activities.

TAKEAWAY

EVALUATING IP

When making decisions about patenting, it is important to consider unmet market needs. Even technically minor improvements can play a vital role in a company’s overall IP strategy and may well be worth patenting. In the end, market needs decide what is commercially relevant.

The software developed and used by Lithoz is usually protected by copyright. In addition, one of the in-licensed patents covers a computer-implemented invention relating to the modulation of the printer’s light source and has already been granted in two countries. With the purchase of the 3D printer, the customer is implicitly entitled to use the software, even though there is no explicit licence contract stating this right.

Pushing boundaries

The in-licensed patent portfolio consists of 55 applications in six patent families with priority dates ranging from 2008 to 2012. Ninety percent of the applications have already been granted. The European patents were all validated in Austria, Switzerland, Germany, France, United Kingdom, Italy and Sweden, and some of them in The Netherlands and Spain as well. The selection was done by Ivoclar and TU Wien, although Lithoz was involved in the decision-making. These patents cover Lithoz's key markets; however, Lithoz is now doing business in other countries as well.

Between 2014 and 2016, Lithoz filed three patent applications. "When our next patent is granted in Europe, it would be great if the Unitary Patent system were already in place, as it would make the procedure and our decisions much easier," Homa said. The Unitary Patent system is designed to be simpler, while continuing to provide high legal certainty with wider geographic protection at a lower cost. Thanks to Ivoclar's decision to protect the platform technology extensively in Europe, the core European patents have already been validated in more countries than the university usually chooses. As all these patents were accessed with the licence granted to Lithoz, this gave them a much better starting position. Because Ivoclar had already taken over patent filing costs, Lithoz was at a financial advantage at its foundation, as was the university, because it was not under any pressure to recover these costs. The university, the spin-off and the partner all benefitted from this scenario.

"The Unitary Patent with its wide range of countries and lower cost makes it easier for universities to target the full potential of an invention in Europe."

Peter Karg

Head of Research and Transfer Support, TU Wien

Universities usually have to deal with inventions at an early stage. Very often, these early-stage inventions have many different fields of application, some of which may not even be fully known at the time of patenting. At this early stage, the market potential is hard to predict, making it difficult for university management to justify the cost of wide-scale patent protection. Furthermore, the set of countries suitable for one area of use may not be appropriate for another field of application. This can significantly limit the chances of success for exploitation and also for possible start-ups.

COMPANY PROFILE

LITHOZ GMBH

- > Headquarters: Vienna, Austria
- > Year of establishment: 2011
- > Staff: 36
- > Turnover: EUR 1 million–EUR 10 million
- > www.lithoz.com

PRODUCTS/SERVICES

3D printing systems for high-performance ceramics. The technology is based on the selective curing of a photosensitive resin which contains homogeneously dispersed ceramic particles. The process makes it possible to manufacture extremely dense and strong machine parts with industrial applications.

MARKET AND TECHNICAL AREA

Ceramics manufacturing

CUSTOMERS

Universities and research centres, producers of ceramic parts, biomedical companies

SELECTED AWARDS

- 2013 Phoenix Award
(Austrian Ministry of Science and Research)
- 2014 National Champion
(European Business Awards)
- 2014 Hidden Champion Award
(Austrian Chamber of Commerce)

PATENT PORTFOLIO

Six in-licensed patent families, including EP2505341
Three own applications, including WO2016154645

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