



How Origin One and Forward AM drive material development

Origin One's industry leading Open Materials License (OML) is based on feedback from three years of deep partnerships with the leading chemical manufacturers



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Material development timelines can range from a few months to years. Origin One hardware and software provides a flexible, consistent and fast printing process and environment to shorten our material development cycle.”

Erika Fantino
Head of Business, Photopolymer,
BASF 3D Printing Solutions GmbH

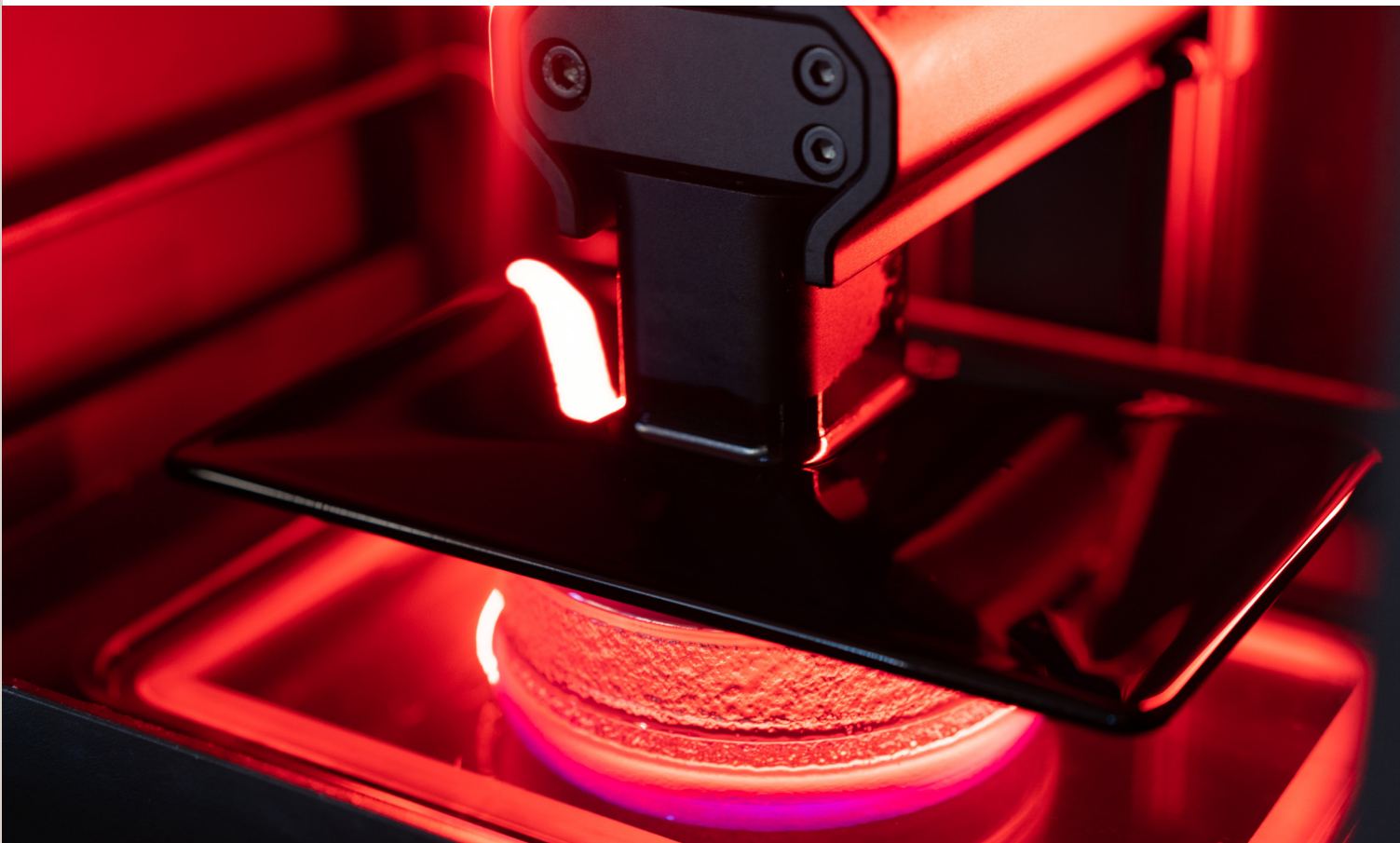
Reduce development time with exceptional control and reliable prints.

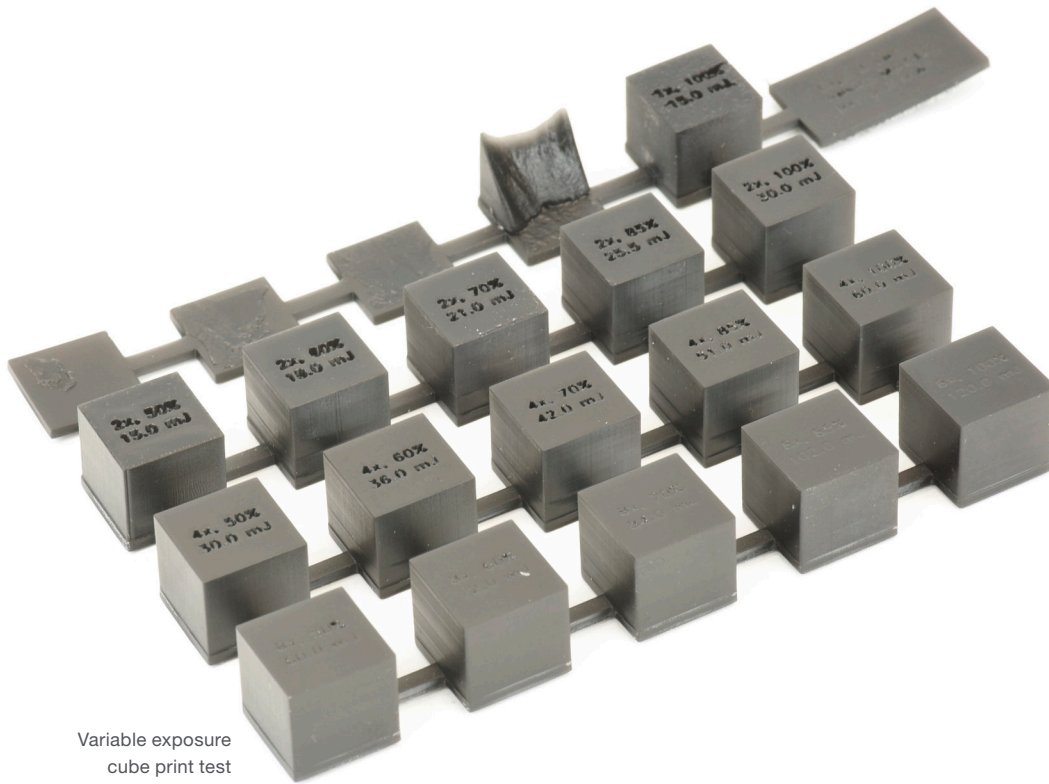
The material development partnership between the Origin One team and Forward AM, BASF's 3D Printing Solutions brand, predates the first Origin printer launch, and its influence is apparent in every aspect of our technology. A core part of our materials strategy is providing material developers the tools needed to fine tune their processes and accelerate their development cycles. The result is our industry leading, robust offering of adjustable parameters and measurements that ensure testing can be controlled precisely.

"Origin is one of the few machines on the market achieving very high degree of conversion directly from the platform," BASF 3D Printing Solutions GmbH's Erika Fantino, Head of Business, Photopolymers. "The flexible adoption of the

machine's printing parameters to the chemical characteristics of the resins makes it a perfect match for Forward AM and joint customers' needs."

As a culmination of what we've learned from Forward AM and other material partners' development cycles, we've launched the Open Materials License (OML), an advanced software tool empowering academic and state researchers, material formulators and advanced manufacturers to define custom configurations on the Origin One. The OML includes the ability to fine tune an expanded list of parameters, resulting in not only faster time to market, but also an expansion of the types of groundbreaking materials that can be used by each organization.





Variable exposure
cube print test

Why are print controls important for material development?

Forward AM is a 3D printing material solution provider focused on designing durable materials for industrial-scale manufacturing of end-use products. Parent company BASF is one of the biggest worldwide producers of raw materials and “building blocks” (frequently used basic synthesized chemistries) needed for the novel PU-based photopolymer resin formulation. BASF offers photopolymer formulations for automotive, consumer goods and furniture, as well as construction applications. Their business relies on creating reliable materials that behave exactly as tested – which made partnering with Origin an easy choice.

As Fantino explains, “During material development cycles at Forward AM, we always look into material behavior in response to various factors and printer settings. There are many questions that need to be answered to establish structure-property relationships, as well as the ability to control and manipulate it. Once we understand the kinetics of cure and materials’ response to stimuli, we can

predict, troubleshoot, and advise our customers how to use our materials in various applications.”

The OML grants full control over the minutiae of each print, with the ability to customize over a dozen parameters. In addition to advanced software capabilities, the Origin One’s incredibly fast print speed and reliability, and high green strength make it ideal for accelerating your development by greatly diminishing the frequency of failed prints. Users can also create material profiles – a set of predefined print parameters – as desired, which adds further efficiency and consistency in development.

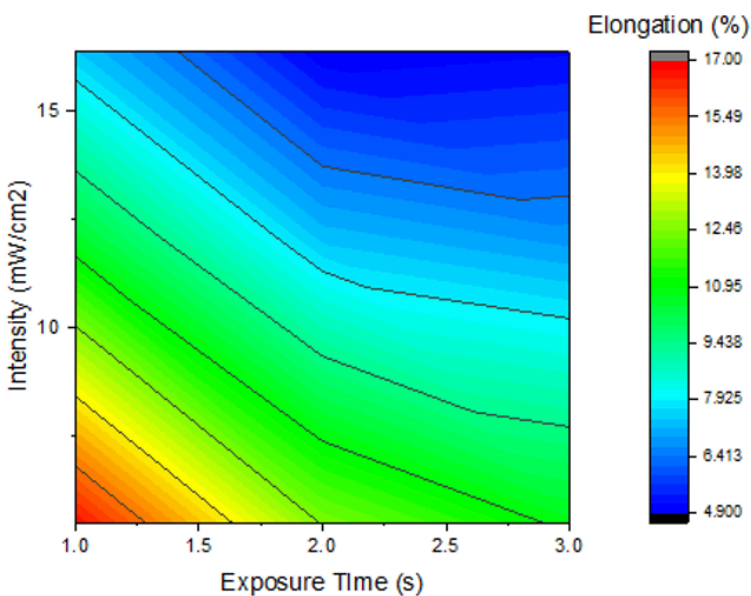
User-configurable settings through Origin One’s OML:

- Custom layer thicknesses
- Temperature
- UV exposure
- Movement parameters
- Scaling
- Accuracy compensation
- Build style (fast | slow)



Forward AM's development process evolves with Origin One.

The process for developing a new printing material starts with a Target Profile, or the testing goals set out for that material based on consumer need and market demand, and is how a material is defined as ready to go to market. This entails numerous – usually over a dozen – tests performed in BASF's R&D lab and application technology center, an increasing number of which are now performed on the Origin One.



Printing parameters influence the degree of conversion and ultimately on part performance, in this case how modifying UV exposure intensity and time affects percent elongation.

Forward AM's testing protocol involves Design of Experiments (DOE), a method that defines cause and effect findings and ensures that all factors are accounted for. They primarily use mixture DOE, which focuses on varying the proportions of chemical components to achieve desired material properties. The ease and speed of this process is highly dependent on the machine being used for the testing.

"Fast printers deliver fast results. In our quest for new formulations, in order to achieve the desired balance of properties, each formulation has to be 3D printed and tested. With fast turnaround typical of Origin printer, we can test two and sometimes

three different formulations on the same day." Fantino said. "A 3D printing study involving a dozen or more formulations, physical testing and statistical analysis could be conducted within a week. This pace accelerates the progress and generates fast results."

Once internal testing is complete and the new material has met the desired qualifications, it then is released to a selection of partners and customers. These organizations will introduce their own variables to continue testing and iteration, and ensure that the new offering is ready for general availability and will perform exactly as intended.



An OML designed for advanced users, manufacturers and educational institutions.

Organizations that are developing new materials are the key to advancing the industry, but success in this process relies on having quality equipment and supplies. With the Origin One printer in the lab, every R&D department will be enabled to increase the speed, accuracy, and repeatability of their prints, add greater diversity to testing capabilities, and more easily bring new technicians and chemists up to speed.

“The high quality of printer design combined with reasonable cost position ensures its wide availability on the market accessible by our new products. On the other hand, the simplicity of use and reliable performance make this printer an invaluable developmental tool,” said Kresse. “In order to track changes and improvements in product performance, one has to have solid tools that perform the same way day in and day

out. Origin delivers the same quality every day and allows us to track our product development progress.”

The future of 3D printing and additive manufacturing relies on continual improvement of both machines and materials. Stratasys is committed to continually improving our machines to better serve our end users, which include customers, material suppliers and partners; we know that the next breakthrough in materials can’t happen without best-in-class hardware, and that the same hardware is useless without incredible materials to print with. As an industry, it is critical that we collaborate across our disciplines and continue to march forward towards a bright manufacturing future that reduces waste while redefining what’s possible.

Reach out to your Stratasys contact today to learn more, and be a part of what’s next.

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