FIELDLAB MULTIMID WORKS HIGHLY PROMISING SOLUTION FOR BILLION EURO MARKET

CREDIBLE DENTURES THANKS TO 3D-PRINTING

An older person smiles and a straight row of snow-white teeth appears. Not real, you know immediately. Not only because it is unlikely that someone of that age still has such beautiful teeth, but even more because it is too uniform and too white. It is very difficult to imitate that. In the Smart Industry fieldlab Multimid, the Smart Industry initiative of EME, TNO-Novo, the Ministry of Economic Affairs and Climate Policy, Stimulus and TNO—has three work packages. One focuses on SD printing of ceramic materials, a second on printed electronics (see box). The third one, in which O&O is active, therefore involves 3D-printing of teeth. O&O, a division of Canon, does this together with specialists from TNO AM SYSTEMS Centre (Additive Manufacturing Systems Centre), NextDent and TNO I&SMC (Brightland Materials Center). Each party is responsible for its own package. Project partner NextDent from Soesterberg (supplier of dental products for eighty years and part of the American 3D Systems since the beginning of 2017) provides an FDA approved monochrome material that is 3D-printable on the basis of VAT-photopolymerisation (cured with UV light). TNO I&SMC, located on the Highlands-Chemelot Campus, modifies this dental resin to make it printable and suitable for colouring teeth and acquiring the mechanical properties of teeth. TNO AM SYSTEMS Centre focuses on the integration of the VAT and inkjet technologies into a complete 3D printer. In addition, Van Mierlo Ingenieursbureau (specialist in the realisation of hardware and software solutions for measurement and control problems), as O&O’s partner, develops the required control electronics of the printheads.

FIELDLAB MULTIMID

The Fieldlab Multimid is a co-creation platform of industrial parties from the entire value chain and knowledge organisations. Three multi-mid use cases have been defined based on business questions. In addition to the research on dental applications, we are working on:

1. Large-area ceramic printing for high-tech applications. This offers opportunities for producing large surface machine parts in a significantly shorter time and at significantly lower costs. The challenge lies in the integrated development of the combination of material, process and equipment.

2. Integrated electronics opens up new possibilities in product design and functionality of consumer electronics products, such as LED lighting with integrated electrical functions. The technology developed by the company for so-called 2.5D printing, a form of 3D printing up to a height of about 5 millimetres, also comes in handy. This method is especially effective for complex and all Dutch masters including the paint structure can be printed. In addition, the Venlo company has advanced (2D) colour management software. O&O also studies 3D workflow software. The 3D structure of a tooth is made up of—what is called in the sector—3D-pieces. For example, 40 by 40 by 40 micrometres. If they are all of the same size and colour for 2.5D printing, for printing teeth that are not distinguishable from real teeth, each voxel must have its own characteristics—colour and transparency. This is possible thanks to our 3D Colour Workflow software, which accurately translates the digital design of the tooth into a machine-readable printhead file. With our printhead and control software and the VAT printer from TNO AM SYSTEMS, we are able to print every voxel in exactly the right colour and transparency in exactly the right place. And it does it rapidly. A complete tooth can be printed within half an hour. In the fieldlab digital piezo inkjet printheads specially developed for highly viscous materials and high temperature are used for this 3D printing (O&O also supplies these in wide-format colour printers such as the ColorWave 600). For future products O&O is currently developing NEMS (nano-electro-mechanical systems) printheads that are made in chip factories. This new generation of printheads is not only more compact and cheaper, but also much faster and more accurate.

BILLION EURO MARKET

O&O and its fieldlab partners are making this effort because they foresee a large market. Expectations are that in ten years’ time artificial teeth will be exclusively 3D printed, good for global revenues of ten billion euros, says Van der Meer citing a market survey of Smart Tech Publishing (2018). The Fieldlab-Material-3D Printing Project Plan (2018) reports that approximately four million dental prostheses are produced annually in the Netherlands alone. The number of crowns and bridges is a multiple of this. The consumer price for a crown (un-placed) in the Netherlands is currently around 230 euros, for a partial prosthesis this is about 160 euros.

‘Expectations are that artificial teeth will be exclusively 3D printed in ten years’

The total turnover of Dutch dental laboratories for these two types of dental work is therefore hundreds of millions. If it is possible to print aesthetically-acceptable multi-colour teeth for dental prostheses and bridges, the market for dental prostheses and bridges work, twenty per cent of the dental items can be made in the Netherlands within four years. The revenue model of NextDent is based on the number of pieces. For this reason, the company is challenging its competitors to come up with a solution that is just as good or even better, and that fulfills all the requirements of the dental market.

IMPLEMENTATION AGENDA: ACCELERATE DIGITALISATION

Smart industry is changing the industry radically, but leading the way in this digitalisation is crucial. That is why the Smart Industry Team set up the Implementation Agenda 2018–2021 during the Smart Industry Event at the beginning of February, Chairman Ir. Duno Jansen presented it to Moniek Keijzer, Secretary of State for Economic Affairs and Climate Policy. The agenda wants to speed up the simplification of companies, so that in 2031 the Netherlands has the most flexible, digitally connected and competitive production network in Europe. There are nine projects:

1. Smart Industry Assessment Programme. Helping companies to get started with Smart Industry.

2. Smart Industry Expertise Centre. One-stop shop for companies.


5. Linking skills labs to fieldlabs. Making every fieldlab a skills lab.


8. Data Sharing Programme. Establishing the Data Value Centre and the Data Share Coalition.

9. International business with Smart Industry. Setting up concrete cooperation projects in the Netherlands, Germany and Belgium.

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