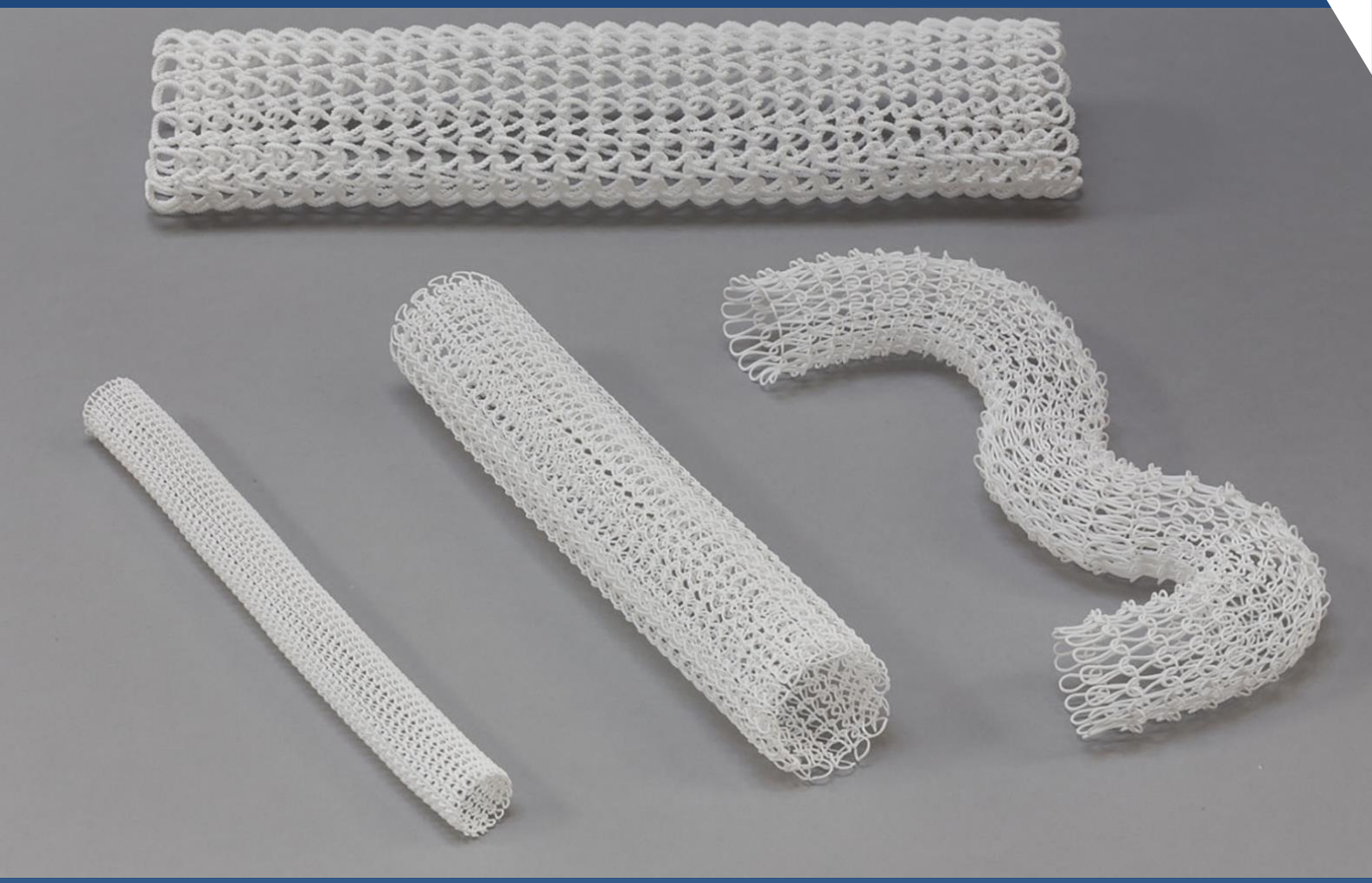

3D PRINTING OF WEFT-KNITTED TEXTILE BASED TUBULAR STRUCTURES USING SELECTIVE LASER SINTERING OF NYLON POWDER

Overview

This research investigates the materialisation of 3D printed textile based tubular forms that make use of knit's primary structures. Knitted structures are formed by the inter-looping of a continuous thread to create symmetrical loops which create the structure. These loops can be easily stretched in different directions giving knitted structures their inherent stretch and elasticity. This research takes two of the primary structures of knit (plain knit & interlock) to develop a range of 3D printed tubular knit based structures. These structures are explored in synthesis with knit's inherent properties of stretch and flexibility an aspect currently unexploited in the testing of 3D printed knit structures.

Process

3D printing is a form of digital additive manufacturing whereby the building up of layers of material creates objects. The selective laser sintering process (SLS) uses a laser beam to sinter powdered material to create objects. In the SLS process a carbon dioxide (C02) laser is used to fuse fine powder into solid material. The laser is directed by a computer guided mirror and builds objects in layers of 0.1mm, the building platform lowers down by this measurement each time allowing the next layer of powder to be rolled onto the surface. The non-sintered powder acts as a support material for the build object. The excess powder is then removed by high pressure after printing. This process has the advantage of being able to print complex geometries without the use of additional support material making it an ideal method to explore fine interlocking textile based structures. The 3D printed structures for this study were printed by London based bureau Digits 2 Widgets using an EOS Formiga P1 machine. These machines are calibrated up to ±0.15% on the X and Y-axis and build with 0.1mm layers on the Z-axis.

Material

The SLS process is compatible with a variety of Nylon based powders. Nylon is a popular engineering thermoplastic due to its lightweight, strong and flexible properties because of this it has been used by numerous designers to successfully print articulating structures. Nylon has outstanding mechanical properties including low moisture absorption, good dimensional stability and superior flexibility. This study explores the possibility of using SLS of Nylon (PA2200) powder to create flexible (PA2200) powder to create flexible weft-knitted structures at various scale.

Testing

This research builds upon previous research into 3D printed textile based structures exploring the use of SLS of Nylon powder to create flexible weft-knitted structures. This study focuses on testing both single-face (plain) and double-face (interlock) weft-knitted tubular structures. The 3D printed knit structures are evaluated in terms of their ability to be compressed and extended, alongside their stretch capabilities and overall flexibility. The results show the potential to print flexible, tubular textile based structures at various scale that exhibit the properties of traditional knitted textile structures along with the mechanical properties of the material used to print with. This research is speculative in nature however, it is anticipated that the results could be utilised within various technical textiles sectors.

“The results show the potential to print flexible, tubular textile based structures at various scale that exhibit the properties of traditional knitted textile structures ”

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D2W

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Structures printed by Digits 2 Widgets (https://www.digits2widgets.com)

Image credits: Digits 2 Widgets

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