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Experimental analysis of carbon fibre impregnation influence on 3D printed composites mechanical properties

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Additive layer manufacturing (ALM) is mainly used for production of very complex geometrical shape products. Important to mention that it is the main advantage of ALM because without the use of the moulds various products can be produced easier and faster. In this study a novel 3D printing technique for continuous carbon fibre reinforced polymer composites is presented. First of all, preparation of carbon fibre and adhesion testing between matrix material (PLA) and reinforcement (1 K carbon fibre) is presented. Figure 1 shows the procedure of carbon fibre modification. Tendency of tensile force changes can be clearly seen in the Figure 2, when the carbon fibre impregnated with 4 % and 8 % concentration solutions tensile force average increased from 50 N till 134 N and 150 N respectively. Adhesion results between matrix material and modified carbon fibre is presented in Figure 3. Moreover, it can be concluded that solution concentration and heating time is important and can influence mechanical properties of printed parts. For the printing of samples polylactic acid (PLA) was used as matrix material and 1K not twisted carbon fibre as reinforcement material. Quality of 3D printed samples were tested by using computer tomography and optical surface morphology. Tensile tests of printed samples showed (Fig. 4) that even low content of carbon fibre in polymeric composite can increase mechanical properties significantly.

Fig. 1 Procedure of carbon fibre modification

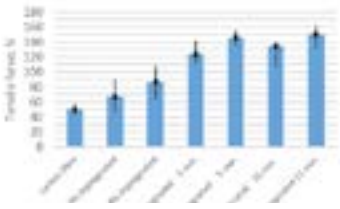

Fig. 2 Results of carbon fibre tensile tests

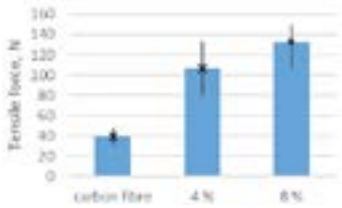

Fig. 3 Adhesion testing results

Fig. 4 Mechanical properties of printed composites

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Biography

Rūta Rimašauskienė in 2010 defended PhD theses in the field of Mechanical Engineering in Kaunas University of Technology. Currently she is involved as a researcher in M-ERA.net project "Additive Manufacturing of Continuous Fibers Reinforced Polymer Composite Materials for High Performance Structural Applications (2017-2019). Since 2013 Rūta works as Associated Professor at the Department of Production Engineering, Kaunas University of Technology. She has published more than 25 papers in reputed journals and conferences proceedings.

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