CELLULOSE NANOCRYSTAL REINFORCED POLYAMIDE 12: USE OF DIRECT EXTRUSION FOR ADDITIVE MANUFACTURING

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Extrusion based additive manufacturing (EBAM) is a great tool for producing prototypes or custom parts, such as patient-specific biomedical devices. Some of these applications require high stiffness and strength values that cannot be achieved using non-reinforced polymeric filaments that are conventionally used in EBAM. The limited number of reinforced filaments that are available in the market usually utilize reinforcing agents, such as graphene or carbon nanotubes, that cannot be used in some specific applications. Furthermore, finding the filaments with the desired reinforcement and matrix combination, and the correct fiber volume fraction is an additional challenge to realize the full benefits of this technique.

Cellulose nanocrystal (CNC) is a bio-based and bio-compatible reinforcing material that have attracted significant attention in recent years because of its bio-degradability, low density, high aspect ratio and exceptional Young's modulus. Polyamide 12 is a commonly utilized engineering polymer in a broad range of applications. CNC reinforced polyamide 12 nanocomposites have great potential in the future. In this paper, we report on the preliminary findings of CNC reinforced polyamide 12 nano-composites produced using direct extrusion with EBAM thus eliminating the need of forming and using a filament. Mechanical properties and crystallinity data of the composites with respect to various CNC concentration are reported. Advantages and disadvantages of the process are discussed.