THERMAL PHYSICAL MODEL OF COMPOSITE CREATION IN LOM TECHNOLOGY

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Modern additive manufacturing (AM) processes can be classified into seven categories: Powder Bed Fusion, Material Jetting, Directed Energy Deposition, Binder Jetting, Material Extrusion, Vat Photopolymerization and Shit Lamination. Laminated object manufacturing (LOM) and ultrasonic additive manufacturing (UAM) are the two main categories of the sheet lamination processes. In these, material sheets are either cut by using laser or combined by using ultrasound. In turn, LOM can be further classified based on the bonding mechanism between the sheets. Initially LOM-process was developed to produce the parts from paper at the low temperature and without explicit chemical reactions. Then the basic idea was disseminated to other green materials, when sheets can be joined by intermediate layers due to diffusion, filtration, and chemical reactions. Today LOM – process belongs to the quickly developing technique for metal and ceramic layered composite production. In this paper the model is suggested to investigate physical-chemical conversions in adhesive layer between conjugated layers with different properties during LOM-process. Adhesive bonding layer is used, for example, during one of way of ceramic formation from pre-ceramic paper sheets [1].

It was detected that reaction can starts in form of thermal explosion in spite of low energetic parameters and in the form of slow accumulation of the reaction product. This depends on contact area size of roll and synthesized composite, roll velocity and temperature.

Generally, ceramic paper formation consists of several separate stages [1,2], each of which is accompanied by physical-chemical conversions that affect the properties of final product. These are the stage of paper formation from green suspension containing fibers, fillers, retention aids and binder; the stage of conversion of pre-ceramic paper that could be organized by various ways depending on find of fillers and the desired composition of final products; the stages of sintering, infiltration, and certainly laser cutting. Using described above approach one can to predict the possible mode of structure and composition formation. Detailed chemistry could be taken into account similarly to [3]. Some results were published in [4].

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References

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