

## Application of nanotechnology in additive manufacturing: Prospectus and challenges

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**Abstract:** Additive manufacturing is one of the emerging technique that has given a whole new dimension to the manufacturing methods as the parts can be directly fabricated in an additive manner from the model without any process planning. However the narrow choice of materials used in Additive Manufacturing (AM) is one of the major limitation of the process. In this regard, nanomaterials can offer the potential to advance AM materials through modification of their fundamental material properties. The synergistic approach of nanotechnology with AM has the potential to both enhance the existing techniques as well as to create wholly new nanocomposites. For instance, when the size is reduced from macro to nano, the fundamental properties of the materials undergo a change in optical, thermal, and electrochemical properties that differ from the properties of the bulk material. The aim of this study was to review the incorporation of the nano-based materials including metal, ceramic, and carbon into AM technologies such as stereolithography, laser sintering, fused filament fabrication, and three-dimensional printing. In case of stereolithography the use of nanoparticles resulted in the increase in tensile strength and thermal stability. In laser sintering, the nanoparticles helped in improving the compressive strength and mechanical properties. In fused filament fabrication, the nanoparticles enhanced the shear strength and elastic modulus of inks. Overall, we find promising results in the application of nanomaterials and AM, yet significant work remains to fully harness their inherent potential. We conclude that much work is to be done in this field of research as there are many applications and rewards in the integration of additive manufacturing with nanotechnology.

### References:

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