ABSTRACT

Rapid prototyping (RP) technology is a new field in the manufacturing process. Unlike conservative manufacturing processes which are subtractive manufacturing process, RP applies an additive manufacturing approach. The layer-by-layer process mechanism of RP allows this technology to create complex geometry which is hard to achieve by traditional means. Fused deposition modelling (FDM) is one of the common processes in RP. In FDM, the raw material used is a spool of plastic filament, and polylactic acid (PLA) and acrylonitrile butadiene styrene (ABS) are the most common used materials. The plastic will be extruded through a heating element, then the plastic will be melted and will be extruded through a nozzle to create an exact shape of a part, in layer-by-layer means. In this project, layer thickness and infill material percentage are the parameters taken into consideration. The plastic injection molding specimen recorded 50.19363 MPa ultimate tensile stress, and used as a benchmark result. The commercial FDM recorded results in a range of 53.65% to 64.04% from the injection molding result, while the low-cost FDM was about 20.28% to 31.48%, depending on the case. Meanwhile for the compression test, the commercial FDM was obtained about 25.6 MPa to 46.17 MPa, depending on the case, while the low-cost FDM recorded in a range of 60.49% to 69.54% from the commercial FDM machine.

ABSTRAK

Teknologi sulungan cepat (RP) merupakan satu bidang baru dalam proses pembuatan. Tidak seperti proses pembuatan konservatif yang merupakan proses pembuatan subtraktif, RP mengaplikasikan pendekatan pembuatan tambahan. Mekanisme lapisan demi lapisan proses sulungan cepat membolehkan teknologi ini untuk mencipta bahan yang mempunyai geometri yang kompleks yang sukar untuk dicapai dengan cara tradisional. Pemodelan pemendapan terlakur (FDM) merupakan salah satu proses yang selalu digunakan dalam RP. Dalam FDM, bahan mentah yang kerap digunakan adalah filamen plastik, dan asid polilaktik (PLA) dan akrilonitril butadiena stirena (ABS) adalah bahan-bahan yang selalu digunakan. Bahan plastik akan diekstrusi menggunakan mekanisme ekstrusi melalui elemen pemanas, sehingga plastik tersebut mencair dan akan diekstrusi melalui sebuah muncung untuk membuat bahagian dalam bentuk yang tepat, dengan cara lapisan demi lapisan. Dalam projek ini, ketebalan lapisan dan peratusan pengisian bahan adalah parameter yang dipertimbangkan. Spesimen daripada pengacuan suntikan plastik untuk tekanan tegangan muktamad yang direkodkan adalah 50.19363 MPa, dan digunakan sebagai tanda aras hasil. FDM komersial merekodkan keputusan dalam lingkungan 53.65% ke 64.04% dari keputusan pengacuan suntikan, manakala FDM kos rendah pula dalam lingkungan 20.28% ke 31.48%, bergantung kepada kes. Bagi ujian mampatan pula, FDM komersial mendapat hasil dalam lingkungan 25.6 MPa ke 46.17 MPa, bergantung kepada kes, manakala

FDM kos rendah merekodkan dalam jarak 60.49% ke 69.54% daripada mesin FDM komersial.

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LIST OF ABBREVIATIONS

RP	-	rapid prototyping
FDM	-	fused deposition modelling
LOM	-	laminated object manufacturing
3DP	-	3-dimensional printer
SLS	-	selective laser sintering
SLA	-	stereolithography (process)
STL	-	stereolithography (file format)
CAD	-	computer aided design
LENS	-	laser engineered net shaping
SGC	-	solid ground curing
MJM	-	multi jet modeling
PLA	-	polylactic acid
ABS	-	acrylonitrile butadiene styrene
HDPE	-	high density polyethylene
LDPE	-	low density polyethylene
PP	-	polypropylene
UPVC	-	unplasticized polyvinyl chloride
PMMA	-	poly(methyl methacrylate)
NCDS	-	nano composite deposition system