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Metal matrix composite from recycled materials by using additive manufacturing assisted investment casting

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Abstract- In this research article, a novel method of additive manufacturing (AM) assisted investment casting (IC) has been demonstrated (by using the patterns prepared from waste materials reinforced with ceramic particles) for development of a metal matrix composite (MMC). In first stage, recycled low density polyethylene (LDPE) has been selected as matrix material, while ceramic reinforcement of SiC and Al₂O₃ has been blended in LDPE by screw extrusion. Initially, the recycled LDPE has been collected in granules form from the local market and processed on single screw extruder to prepare pellets. The ceramic particles and LDPE were blended together to prepare the final blend in different proportions on twin screw extruder. After that Taguchi L9 orthogonal array has been employed to ascertain the effect of different input parameters of FDM machine to prepare the functional prototypes in the form of cubical patterns. Instead of using conventional IC, a rapid method has been employed to prepare sacrificial pattern by using siladent powder (which is being used for preparing cast in clinical dentistry for dentures). Further this method has been explored as an alternate route of rapid IC, which requires very less time as compared to the traditional methods. At final stage cast were prepared with aluminium (Al) alloy as matrix material reinforced with SiC and Al₂O₃ (which were present in the mould cavity after removal of LDPE). The properties of MMC prepared via this novel route were subjected to hardness and grain size testing supported by photomicrographs and EDAX analysis.

Keywords: - LDPE, additive manufacturing, investment casting, MMC

Introduction:-

The rapid growth of plastic consumption in different applications inspired the research of innovative recycling procedures [1-2]. Plastic/polymer solid waste (PSW) is presenting new

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